Journal of Applied Pharmaceutical Research
Volume 14 Issue 3, Year of Publication 2026, Page 36 – 52
DOI: https://doi.org/10.69857/joapr.v14i3.2116

Check for updates

Review Article

JOURNAL OF APPLIED PHARMACEUTICAL RESEARCH | JOAPR
www.japtronline.com *ISSN: 2348 – 0335*

A SCIENTIFIC DATA-DRIVEN COMPREHENSIVE REVIEW ON SEVEN PREVALENT SPECIES UNDER ACACIA (FABACEAE): INSIGHTS INTO PHYTOCHEMICAL INVESTIGATION AND PHARMACOLOGICAL POTENTIALS

Shreetama Roy[1]*, Amrita Ghosh[1], Milan Jana[1], Jyochhana Priya Mohanty[1], Nihar Ranjan Bhuyan[2]

Article Information
Received: 17th February 2026
Revised: 10th April 2026
Accepted: 30th April 2026
Published: 15th May 2026

Keywords
Acacia, Fabaceae, Phytochemistry, Anti-inflammatory, Cytotoxic potential, Antioxidant.

ABSTRACT
Background: In traditional medicine, plants are important. For ages, various medicinal plants have been used for traditional medicine formulations, many of which are still in use today. There are many species under the genus Acacia that are important for medicine, most of which are found in Asia. Numerous species in the genus Acacia have long been used to treat a range of conditions, from mild ailments to serious cancers. Several species in this genus have been used in pharmaceutical and cosmeceutical formulations and have achieved commercial success due to their versatile medicinal properties. **Methodology:** The review followed the in-depth analysis of seven prevalent Acacia species. After screening an initial pool of approximately 500 articles on these species from sources such as PubMed and Scopus (2000–2026), around 120 publications were selected based on inclusion criteria (e.g., a focus on phytochemistry/pharmacology). This timeline highlights the novelty of the review while documenting emerging findings. **Result and Discussion:** Numerous studies in phytochemistry, pharmacology, and toxicology have demonstrated the positive therapeutic properties of substances such as betulin, catechin, diosgenin, kaempferol, and others for illnesses. In addition, numerous novel compounds with intriguing bioactivities have been disclosed by researchers. **Conclusion:** The species' pharmacological investigations and phytochemical analyses have been addressed and explained. In addition, botanical description and traditional applications are briefly discussed. The isolated compounds and their biological activities are discussed. All things considered, the genus Acacia emerges as a notable source of bioactive molecules with significant potential for pharmacognostical and drug development research in the years to come, especially in oncology.

INTRODUCTION

The Acacia genus contains over 1,084 species of shrub types and trees in the subfamily Mimosaceae of the pea family Fabaceae. It is sometimes referred to as wattles. The Neo-Latin name of the genus is derived from the Greek word ἀκακία (akakia). Around the world, a variety of species were introduced into the genus

[1]*Department of Pharmacognosy, Himalayan Pharmacy Institute, Majhitar, Rangpo, Sikkim-737136, India.*
[2]*Department of Pharmaceutical Chemistry, Himalayan Pharmacy Institute, Majhitar, Rangpo, Sikkim-737136, India.*

For Correspondence:** **shreetamadgp@gmail.com

Acacia. The botanical society acknowledged variations within Acacia and that more comprehensive data were required to draw well-informed conclusions about the genus's status, even though it did not adopt this recommendation [1]. Acacia's phylogeny and classification have recently improved as a result of substantial new data from molecular genetics and macroscopic studies. By examining this new data in light of previous studies, we hope to re-evaluate the overall condition of this enormous, widely dispersed genus [2]. The most abundant plant family in the world, Fabaceae, is found across the world & is thought to be the third-largest angiosperm family in terms of species, after the Orchidaceae & Asteraceae [3]. The Fabaceae or Leguminosae family, which includes the legume, bean, or pea family, is a large and economically significant family of flowering plants [4,5].

Wild peas contain flavonoids and terpenoids that are used to cure acne and wrinkles. The flavonoids exhibit antibacterial and anticancer activities. Alfalfa is a member of this plant family, which also contains vitamins A, B, E, and K. *Crotalaria pallida* kills intestinal worms, whereas pulverized *Crotalaria albida* roots are used to heal snake bite victims [6]. To the fullest extent, the chemical diversity of this genus has not been thoroughly studied. Based on the research, this study lists the natural compounds identified from the genus Acacia, along with their biological characteristics [7, 8]. The numerous and potent bioactivities of phytoconstituents present in Acacia species are highlighted in this review, including nematocidal, anti-inflammatory, antioxidant, analgesic, anti-proteolytic, antimutagenic, and antiviral properties [9, 10]. With 38.5% inhibition, loranthin, another polyphenolic compound, showed an interesting scavenging effect when tested against DPPH [11]. Recent research has examined this species' biological benefits, including chemopreventive, hypolipidemic, antioxidant, anti-inflammatory, antihypertensive, antiplasmodial, and antidiabetic properties [12]. The anti-tumor effect of Catechin-5-O-gallate and Gallocatechin-5-O-gallate components was evaluated by measuring their cytotoxicity against ARPE-19 cells. The results showed that these components were selective for tumor cells, with no substantial cytotoxicity observed [13].

Economic Importance

Acacia species are economically valuable because they produce gum, timber, livestock feed, and tannins used in the leather and honey industries. For example, *A. catechu* produces catechu (katha), which is commercially sold at high rates in India for dyes and pharmaceuticals, while *A. mearnsii* is a major source of bark tannins worldwide. By providing nourishing pods and leaves to cattle, *A. nilotica* and other species help address feed shortages in drought-prone areas, thereby strengthening their role in apiculture and soil development [14].

Prevalence in Traditional Medicine

In Africa, Asia, and Australia, the antibacterial, anti-inflammatory, wound-healing, and antidiabetic properties of the species are well documented in traditional medicine [15]. While *A. nilotica* heals skin conditions and tumors, *A. auriculiformis* treats wounds, infections, and malaria, and *A. catechu* acts as an astringent for dental health. Amidst limited access to veterinarians, traditional ethnoveterinary practices, particularly in Ethiopia, emphasize their anti-parasitic and nutritional benefits [16]. The phytochemistry, bioactivity, and traditional uses of this particular group (*A. auriculiformis, A. catechu, A. farnesiana, A. ferruginea, A. nilotica, A. hydaspica*, and *A. mearnsii*) are not covered in any thorough recent reviews (post-2020), despite random earlier studies (e.g., 2012–2020) on individual species. For some, such as *A. nilotica* (pre-2021), there are previous studies, but comprehensive studies of less-reviewed species, such as *A. ferruginea* and *A. hydaspica*, remain limited. This emphasizes the need for an updated assessment to compile new information about their potential for treatment.

METHODOLOGY

Scopus, PubMed, Web of Science, ScienceDirect, and Google Scholar were used to browse the online literature. Several databases were searched for Acacia species and their medicinal properties from January 2000 to 2026.

RESULT AND DISCUSSION

Details about seven prevalent species under the Acacia genus

1. ***Acacia auriculiformis* A.Cunn. ex Benth**

Acacia auriculiformis belongs to the family Fabaceae, straight up, medium in size, evergreen or perennial tree, potentially attaining 30 meters in height, and is generally found on the sides of roads and in most parks of India. The tree is indigenous to Australia and was introduced to West Bengal, India [13]. The vernacular names for the plant include-

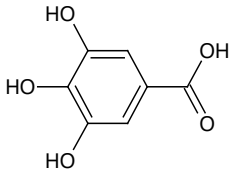
- Bengali- Akashmoni
- English- Australian wattle
- Hindi- Bengali babul

Other vernacular names for the plant include Papuan Wattle, Earpod Wattle, Tan Wattle, etc. Synonyms include *Acacia moniliformis* and *Racosperma auriculiformae*.

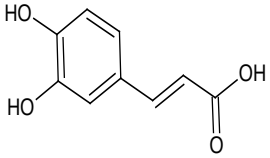
Figure 1: Branches of *Acacia auriculiformis* A. Cunn. ex Benth [17]

Phytochemical constituents

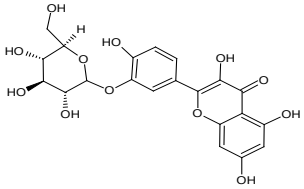
Acacia auriculiformis extracts have a number of flavonoids in the literature. *A. auriculiformis* was used to isolate a novel flavan glucoside, also known as auriculoside or 7,3′,5′-trihydroxy-4′-methoxyflavan 3′-glucoside. From the fruits of Acacia auriculiformis, Gallic acid, caffeic acid, quercetin 3'-O-glucoside (Figure 2), and two novel glycosides were identified as proacaciaside I and proacaciaside II. Two newly discovered acylated triterpenoid bisglycosides that were extracted from *A. auriculiformis* fruits were published. *A. auriculiformis*'s bark contains the leucodelphinidins and leucocyanidins, which turn red when exposed to light [18].



Gallic Acid



Caffeic Acid



Quercetin 3'-O-glucoside Acid

Figure 2: Compounds isolated from *A. auriculiformis*

Structure-Activity Relationship (SAR)

The pyrogallol moiety, which is essential to the pharmacology of gallic acid (3,4,5-trihydroxybenzoic acid), is formed by three adjacent hydroxyl (-OH) groups surrounding a benzoic acid core. The ortho-trihydroxy arrangement enhances antioxidant activities by facilitating strong free radical scavenging through metal chelation and hydrogen atom donating. The ortho-trihydroxy arrangement enhances antioxidant activities by facilitating strong free radical scavenging through metal chelation and hydrogen atom donating. While the carboxylic acid (-COOH) group promotes cancer cell death by increasing ROS and activating caspases, the anti-inflammatory activity depends on the 3,4,5-trihydroxy configuration, which inhibits NF-κB translocation and MAPK pathways [19]. Kaempferol, a flavonol with a 3-hydroxyflavone backbone (rings A, B, and C), has a single -OH at the 4' position on the B-ring. The B-ring 4'-OH provides little ROS quenching, although glycosylation or the absence of 3-OH reduces efficacy. The C-ring's 3-OH and 4-oxo groups form a hydrogen-bonded chelate essential for antioxidant activity, stabilizing radicals. Pharmacologically, the hydrophobic C-ring promotes anti-inflammatory benefits through COX-2 and iNOS downregulation, the planar flavone structure aids in topoisomerase II inhibition and PI3K/Akt suppression for anti-cancer effects, and B-ring hydroxylation increases cytotoxicity against breast cancer lines [20].

PHARMACOLOGICAL ACTIVITIES

2. *Acacia catechu Willd*

Acacia catechu Willd, which belongs to the family Fabaceae, is a deciduous, gregarious tree that grows up to 15 meters tall, with dark brown, glabrous branchlets, and is especially common on sandy soils along riverbanks and in watersheds. The bipinnate, stipulate leaves, flowers are pale-yellow, and the seed pods are dark brown. This tree is native to the dry deciduous forests of India, Myanmar, Bangladesh, Nepal, Bhutan, Thailand, and other regions. Other scientific synonyms for A. catechu include *Acacia sundra* and *Mimosa catechu*. Vernacular names for this plant species are-

- English- Black cutch
- Hindi - Khair, Khaira
- Bengali - Khayer

Figure 3: Branches of *Acacia catechu* [26]

Table 1: Pharmacological potential of *Acacia auriculiformis*

Plant part	Activity	Solvent of Extraction	Ref.
Flowers, leaves, root, and bark	Anti-oxidant activity	Ethanol, Ethyl acetate	21
Flowers and leaves	Antimicrobial activity	Methanol	22
Bark	Antimutagenic and chemopreventive activity	Acetone	23
Leaves	Memory-enhancing activity	Ethanol	24
Leaves	Anti-inflammatory effect	Methanol, Chloroform	25

Phytochemical Constituents

Acacia catechu extracts contain abundant tannins, flavonoids, and other phenolic compounds in the literature. Using electrospray ionization mass spectrometry in conjunction with HPLC, the aqueous extract of *A. catechu* twigs revealed that the main constituents are catechins, which are, by definition, polymers and derivatives of gallic acid (a polyhydroxylated benzoic acid). The main catechins found in *A. catechu* are epicatechin-3-O-gallate, epicatechin, epigallocatechin-3-O-gallate, and catechin, shown in Figure 4. Additional significant secondary products found in the extracts included caffeine, flavonol dimers, and flavonol glycosides [27]. Camphor and phytol were the two main terpene components found in *A. catechu* extract, with additional terpenes present at trace levels, which are associated with its strong antifungal and antibacterial properties [28]. Two novel phenolic compounds, 5-hydroxy-2-[2-(4-hydroxyphenyl) acetyl]-3-methoxylbenzoic acid and (2S,3S)-3,7,8,3′,4′-pentahydroxyflavane, were isolated from the water extract, alongside four previously known components identified as rhamnetin and fisetinidol. The herb is hypothesized to be mentally beneficial and possesses antioxidant qualities. L-arabinose, D-galactose, aldobiuronic acid, D-galactopyranose, etc., resulted after the acid hydrolysis of the gum [29].

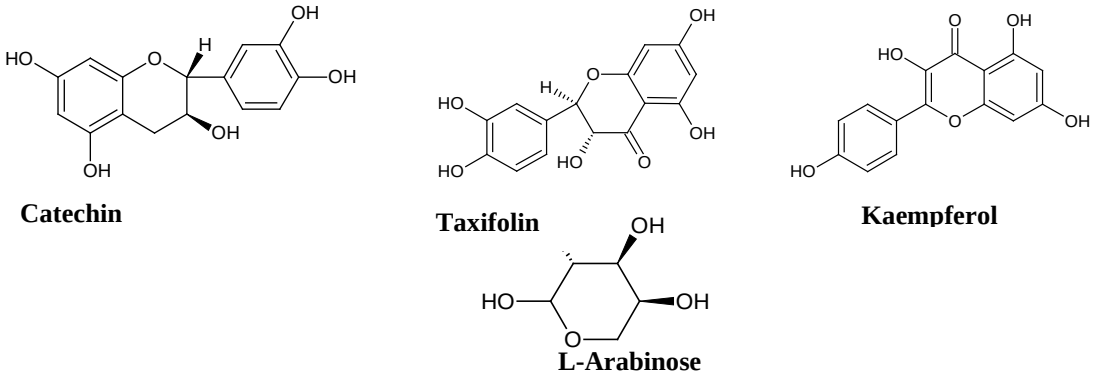


Figure 4: Compounds isolated from *A. catechu*

Structure-Activity Relationship (SAR)

For strong antioxidant radical scavenging, catechin's flavan-3-ol scaffold (A, B, and C rings) depends on the B-ring catechol (3',4'-diOH). 3-galloyl esters enhance this through hydrophobic attachment of galloyl groups to lipid membranes. A-ring 5,7-diOH inhibits NF-κB, and C-ring stereochemistry (2R,3S in natural epicatechin) permits topoisomerase disruption, which results in cytotoxicity and anti-inflammation [30]. 3-OH, 5,7-diOH on the A-ring, and 3',4'-catechol on the B-ring are characteristics of taxifolin (dihydroquercetin), a flavonol with a non-planar C2-C3 saturated bond. Saturation improves metabolic stability, but the 4-oxo/3-OH chelate's moderate antioxidant activity is less than that of planar flavonols; B-ring diOH mediates ROS quenching & caspase activation for cytotoxicity. Through PI3K inhibition, 3'-methoxylation (found in Acacia isolates) increases selectivity for breast cancer cell lines, whereas 5,7-diOH suppresses COX-2/iNOS, conferring anti-inflammatory activity [31].

Pharmacological Activity

3. *Acacia farnesiana* (Lam.) Willd

Acacia farnesiana is a tiny tree or shrub in the family Fabaceae. The perfume industry makes use of its blossoms. *Acacia farnesiana* is a type of deciduous Shrub. The synonyms include- *Acacia acicularis, Acacia indica, Acacia lenticellata, Farnesia odora, and Acacia minuta*.

The vernacular names for the plant include-

- English- Sweet acacia, Fragrant Acacia, Needle Bush
- Bengali- Belati Babul
- Hindi- Bilati Babul,

Table 2: Pharmacological Potential of *Acacia catechu*

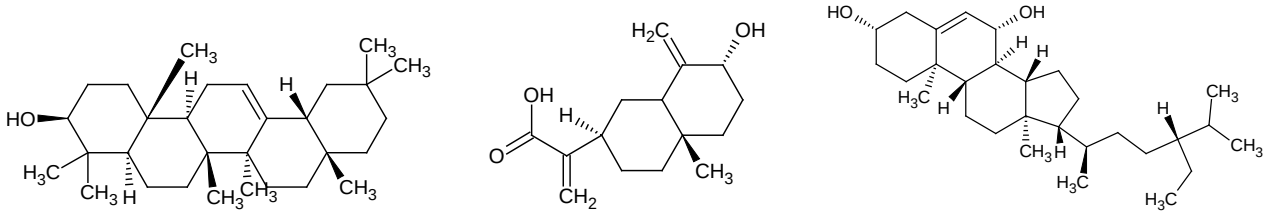
Plant Parts	Activity	Solvent of Extraction	Reference
Fresh leaves	Anti-microbial	Methanol, acetone	32
Bark	Anti-oxidant	Acetone, Methanol	33
Bark	Anti-microbial	Ethyl acetate	34
Bark	Anti-inflammatory	Methanol	35
Stem	Anxiolytic Potential	Methanol	36
Root	Hepatoprotective	Ethyl acetate, Ethanol	37
Seed	Anti-diabetic	Ethanol	38
Seed	Cytotoxicity	Ethanol	39

Figure 5: Branch of *Acacia farnesiana* (Lam.) Willd [40]

Phytochemical constituents

Tetracosanoic-2,3-dihydroxypropyl ester and estigmasta-5,22-dien-3-yl β-D-glucopyranoside were separated and described from hexane and chloroform extracts. Pinitol was identified from the methanolic extract along with methyl gallate, gallic acid, estigmasta-5,22-dien-3-yl β-D-glucopyranoside, and (2S) naringenin 7-O-β-glucopyranoside (prunin). In addition to naringenin and kaempferol7-(6-galloylglucoside), three novel flavonoids were discovered in the dried pods of *Acacia farnesiana*: naringenin 7-O-β-(4″,6″-digalloylglucopyranoside), quercetin 7-O-β-(6″-galloylglucopyranoside), and myricetin 7-O-β-(6″-galloylglucopyranoside) [41].

Flavones, Flavonols, Anthocyanins, and Dihydrochalcones are types of compounds identified by HPLC [42]. Phenolic components were found in the 10.02-28.05 mg of GAE/g range of extractives from several *A. farnesiana* extractives [43]. By using UPLC-ESI-q-TOF-MS analysis, 12 phenolic compounds such as gallic acid, hydroxytyrosol acetate, quinic acid, and caffeoylmalic acid) were found in different extracts [44]. The isolated compounds are shown in Figure 6 below.



β-Amyrin **Viscic acid** **7 β-hydroxysitosterol**

Figure 6: Isolated compounds from *A. farnesiana*

Structure-Activity Relationship (SAR)

The rigid ABCDE ring system of β-amyrin, a pentacyclic triterpene of the oleanane type, has an isopropylidene at C-27, an exocyclic double bond (C-12=13), and a hydroxyl (-OH) at C-3. Acetylation at C-3 improves lipophilicity and anti-inflammatory efficacy by more effectively inhibiting NF-κB.

The C-3β-OH facilitates hydrogen bonding for membrane entry and ROS generation, leading to apoptosis-like death in bacteria via caspase-like stimulation and DNA fragmentation. Through mitochondrial disruption, the C-12 double bond and E-ring flexibility increase cytotoxicity against cancer cells [45]. The C-3 OH, C-12=13 double bond, C-17 COOH & C-28 aldehyde of viscic acid, an ursane-type triterpenoid (3-hydroxy-urs-12-en-27-oic acid-28-aldehyde or related), distinguish it from ursolic acid.

In contrast to monocarboxylic analogs, the planar ursane scaffold inhibits 5-LOX/COX for anti-inflammatory actions, while the C-27/28 dicarboxylic/aldehyde moieties bind metals & form micelles, enhancing antioxidant scavenging of DPPH/ABTS radicals. C-17 COOH, which confers topoisomerase II toxicity, correlated with cytotoxic efficacy against breast cancer cell lines, whereas C-3 esterification increased solubility & GI uptake while maintaining NF-κB suppression [46].

Pharmacological Activity

Table 3: Pharmacological Potential of *Acacia farnesiana*

Plant Parts	Activity	Solvent of Extraction	Ref.
Pods	Anti-oxidant	Hydro-methanol	[47]
Fruits	Anti-microbial (antitubercular and antidysentery activity)	Hexane and chloroform	[43]
Pods	Anti-inflammatory and Anti-oxidant	Successive solvents	[48]
Seeds	Anti-nociceptive and Anti-inflammatory activity	Protein fractions (albumin, globulin, prolamin, acidic and basic glutelin)	[49]
Bark	Cytotoxic, Thrombolytic activities	Hexane, Chloroform and Aqueous	[50]
Pods	Antibacterial	Ethanol	[42]
Leaves	Antimicrobial, cytotoxicity, antioxidant	Ethanol	[51]
Pod	Anti-diabetic	Ethanol	[52]
Leaves and stems	Antidiarrheal	Aqueous and Ethanol	[53]

4. *Acacia ferruginea* DC.

The drought-tolerant *A. ferruginea* tree is a member of the family Mimosaceae and is found in Peninsular India. The trees of *A. ferruginea* DC grow to an average height of approximately 20 meters. The bark is brown, rough, and fissured, with a thickness of 10 to 12 mm. The bark of *A. ferruginea* has traditionally been used to treat hemorrhage, leprosy, and irritable bowel syndrome due to its potent anti-ulcerogenic and antioxidant properties. Larvicidal, anti-inflammatory, anti-cancer, anti-hemolytic, antidiabetic, and anti-hemorrhoidal qualities are found in the bark and aerial sections of *A. ferruginea*. Among the synonyms are: Pedley *Senegalia ferruginea*, *Mimosa ferruginea* [53]. The vernacular names include-

- English: Rusty Acacia
- Hindi: Safed Khair, Kaigar,
- Tamil: Karambai

Phytochemical constituents

There are notable amounts of phytochemical components in the hydroalcoholic concentrate of the bark and leaves of *Acacia ferruginea*. With 34% w/w in the bark and 23% w/w in the leaves, the saponin contents were likewise found to be significant. Flavonoids, steroids, alkaloids, terpenoids, and trace levels of saponins were detected in ethyl acetate preparations of the bark and leaves [54]. Numerous beneficial components, including catechin, hydroxy gamma-butyrolactone, imidazole, procyanidin B1, quercetin, gamma-sitosterol, stigmasterol, lupeol, ellagic acid, and others, were identified through advanced chemical profiling using LC/MS and GC/MS. Research indicates that *Acacia ferruginea* has a high tannin concentration [55]. According to certain research, the total tannins (g/kg) and condensed tannins (g/kg) of raw and dry-heated extracts of Acacia ferruginea seeds are, respectively, 55.1 ± 0.2; 336.5 ± 5.1 and 46.0 ± 0.3; 318.0 ± 9.9% [56].

Figure 7: Branch with flower of *Acacia ferruginea* DC [26]

Such a thorough phytochemical profile highlights the importance of phytocomponents and their potential use in industrial and therapeutic domains [57]. Among the obtained chromatograms, the maximum % area was observed for Methyl mannose Phenol, 2-methoxy-3-(2-propenyl), stigmasterol, Lupeol, gamma Sitosterol & remaining molecules, each exhibiting below 1 % area at their respective retention times [58].

Pharmacological Activity

Table 4: Pharmacological Potential of *Acacia ferruginea*

Plant Parts	Activity	Solvent of Extraction	Ref.
Leaves, bark	Anti-oxidant activity	Ethyl acetate, Hexane, Ethanol, Distilled water	54
Bark, aerial parts	Anti-inflammatory activity	Hydroalcoholic and Methanol	55, 56
Stem bark	Anti-diabetic	Methanol	57
Fresh barks	Anti-ulcerogenic	Ethyl-acetate fraction of Acetone extract	58
Aerial parts	Anti-tumor activity	Methanol	59
Aerial parts	Ulcerative-colitis	Methanol	60
Fresh barks	Anti-cancer	Acetone	52
Bark	Anti-hemorrhoidal	Hydro-alcoholic	61

5. *Acacia hydaspica* J.R. Drummond ex R.N. Parker

Native to arid and semi-arid parts of Pakistan and Northern India, *Acacia hydaspica* is a shrub/small tree species in the family Fabaceae that thrives in arid environments. It can be found along riverbanks and in desert scrub. With bipinnate leaves with tiny, fine leaflets, yellow globular flower heads, and flat, thin, long, and narrow seedpods, the plant can reach a height of one to three meters [62]. The scientific name for *A. hydaspica* is *A. hydaspica* J.R. Drummond ex R.N. Parker.

The various vernacular names are-

- Pakistan (particularly in Sindhi & Punjabi language) – Kandiari
- East & West Himalayan Region – Pahari kikar, Kikar, Mamat

Other scientific synonyms for the plant include *Acacia eburnean* (L.f.) Willd, *Vachellia hydaspica*.

Figure 8: Branches of *Acacia hydaspica* [26]

Phytochemical Constituents

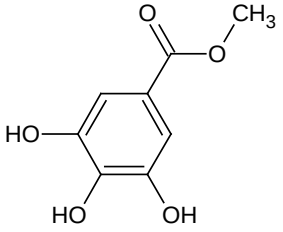
It was shown that the different plant extracts and fractions of *A. hydaspica* included terpenoids, flavonoids, tannins, steroids, sapogenins, and cardiotonic glycosides. Higher levels of polyphenols, including the flavonoid rutin, gallic acid, catechin, and myricetin, which have antidepressant and antioxidant properties, are found in the branch portions of *A. hydaspica* extracts [63,64]. The ethyl acetate (AHE) extract of *A. hydaspica* contains important antioxidant & anticancer chemicals, including catechin, catechin-gallate, and methyl gallate [65].

Based on both yield and activity, 7-O-galloyl catechin appears to be the primary antioxidant component in the aerial portions of the A. hydaspica ethyl-acetate extract, as determined by bioassay-guided isolation. Tannins are isolated from the seeds and bark of *A. hydaspica*. Tannins are found in seeds and bark. Squalene and 2,6-dimethyl-N-(2-methylà-phenyl benzyl) aniline were detected in *A. hydaspica* by GCMS analysis [66]. Bioassay-guided fractionation reported to identify the 7-O-galloylcatechin, methyl gallate, and catechin-3-*O*-gallate as cytotoxic agents (Figure 9). The compounds are identified for their effects on specific cell signaling pathways in breast and prostate cancer models, including the PC-3 and MDA-MB-231 cell lines [67].

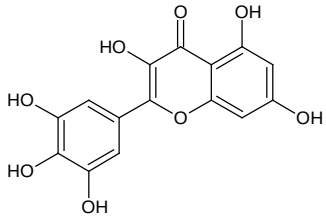
Structure-Activity Relationship (SAR):

By increasing antioxidant activity by 60%, the pyrogallol B-ring (3',4',5'-trihydroxy) enables potent ROS scavenging and free radical quenching. Anticancer actions, including PI3K/Akt inhibition, cell cycle arrest (G0/G1, G2/M), and apoptosis in breast, lung, and liver cancers, depend on the C2=C3 double bond, the 4-keto group, and the B-ring catechol [68].

Galloyl outperforms catechol-carboxylic acid analogs, and its adjacent hydroxyls on the galloyl aromatic ring represent a crucial structure for antioxidant and nanoparticle absorption improvement in tumor cells [69].



Methyl gallate



Myricetin

Figure 9: Isolated compounds from *A. hydaspica*

Pharmacological Activity

Table 5: Pharmacological Potential of *Acacia hydaspica*

Plant Parts	Activity	Solvent of Extraction	Ref.
Bark, twigs, leaves	Anti-pyretic, Analgesic	Methanol, Ethyl acetate	70
Aerial parts	Nephro-protective effect	Ethyl acetate	71
Aerial Parts	Anti-cancer (Prostate, Breast)	Methanol	72

6. *Acacia nilotica* Willd

Acacia species are frequently referred to as "Babool" in India. Family Mimosaceae. *Acacia nilotica* is also known as Nubian acacia. '*Nilotica'* means "Nile valley". The Arabic tree, also known as the Babul tree, Kikar tree, or Indian gum tree, is generally considered a multipurpose tree. Numerous conditions, including toothaches, sore throats, mouth ulcers, malaria & fertility issues, have been treated using *Acacia nilotica*.

It is a potent multipurpose tree that has been used extensively to treat a number of illnesses, including leukoderma, biliousness, diarrhea, ulceration, bronchitis & bleeding piles [73]. The synonyms include- *A. arabica* Delile, *Mimosa arabica*, *Mimosa nilotica* [74]. The vernacular names include-

- English: Indian gum arabica, Black babool, Thorn acacia
- Bengali: Babla
- Hindi: Kikar, Babool, Babula, Babura
- Telugu: Nallatuma, Thumma

Acacia nilotica is an almost evergreen tree with a crown and feathery foliage, found throughout the drier parts of India [76]. Brown to blackish, longitudinally deeply cracked bark. The tree usually attains a height of 15m & girth of 1.2m; flowers golden-yellow, fragrant, crowded in long-stalked pods; pods white, flat, containing 8-12 seeds, 7.5-15cm, contracted between the circular seeds [76, 77, 78].

Figure 10: *Acacia nilotica* (L) branch with flower [26]

Phytochemical constituents

The barks contain range of bioactive substances including 2,3,5-dilgalloyl-2,4-mono- galloyl tannin and methyl gallate. Several other bioactive components have been extracted of the bark, including Chalconaringenin-4′-O-β-glucopyranoside), rutin (quercetin -3-O-ru-tinoside), mollisacacidincatechin-5,7-digallate, and catechin-4′,5-digallate.

These components further indicate the diverse phytochemical profile and the therapeutic potential of the bark extracts. A series of other secondary metabolites have also been reported from Acacia nilotica, which includes dimethyltryptamine, N-methyltryptamine, D-pinitol, T-Sitosterol, Acanilol, Lupenone, Lupeol, Niloticane [79, 80, 81].

Moreover, the pod plant includes sugars, carbohydrates, glycosides, tannins, phytophenols, proteins, saponins, starch, flavonoids, and steroidal nuclei. This highlights the efficiency of 50% aqueous ethanol for extracting phenols and flavonoids from *Acacia nilotica* [82]. The seed oil is enriched with linoleic acid (39.2%) and oleic acid (32.8%) [83]. Studies had reported the presence of Pyrogallol (64.04%), 9,12-Octadecadienoic acid (6.8%), methyl oleate (1.9%), methyl linoleate (1.6%) and N, N-Dimethylglycine (1.3%). These are attributed to be the major phytoconstituents in the methanolic fraction of *Acacia nilotica* [84].

Epicatechin, quercetin gallic acid, umbelliferone, rutin, myricetin, and catechin were quantitatively identified in significant amounts, while botulin (Figure 11) and kaempferol were found in negligible amounts [79]. In addition to that several flavonoids and isoflavonoids were seen along with the flour flavone aglycones: apigenin, acacetin, luteolin, and chrysoeriol. The analysis also detected the flavanols aglycones kaempferol and quercetin, as well as proanthocyanidins, highlighting the rich phytochemical diversity of *Acacia nilotica* [85].

Structure-Activity Relationship (SAR)

According to 3D-QSAR, anticancer activity of Betulin is favoured for non-bulky, negatively charged, electron-donating, hydrophobic groups with acceptance but no H-bond donation at C-3 (secondary OH); Nrf2 activation lowers ROS in diabetes/liver models; SREBP inhibition via C-28 favours lipid/glucose control [86].

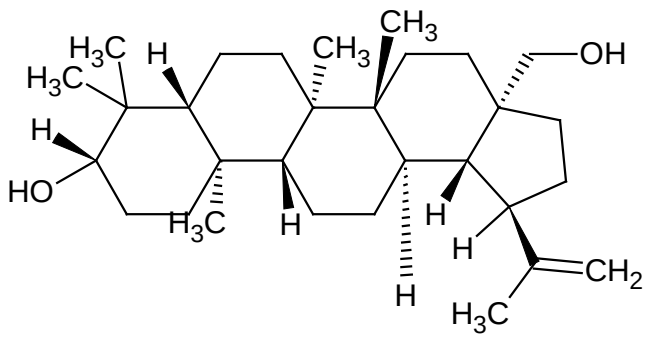


Figure 11: Betulin from *A. nilotica*

Pharmacological activities

Table 6: Pharmacological Potential of *Acacia nilotica*

Plant Parts	Activity	Solvent of Extraction	Ref.
Roots	Antioxidant, Anti-ulcer	Hydroalcoholic, aqueous	82
Leaves	Antimicrobial	Aqueous, ethanolic	87
bark	Antibacterial	Pet. Ether, chloroform, ethyl acetate, acetone, methanol	88
Bark	Antidiabetic	Ethanol	84
Pods	Antibacterial, Antimutagenic	Aqueous	23
Bark	Antileishmanial	Methanolic	88
Pods	Antihypertensive	Ethanolic	89
Bark	Anti-inflammatory	Aqueous	90
Fresh bark	Anti-pyrectic, anti-nociceptive	Aqueous	91
Stems	Anti-inflammatory, neuroprotective	Methanol	92
Leaves, pods, stems	Anti-malarial	Ethanol	93
Pods	Anti-fertility	Aqueous	94

7. *Acacia mearnsii*

Acacia mearnsii De Wild. belonging to the Fabaceae Lindl. family, Caesalpinioideae subfamily, Acacieae tribe, and *Acacia* genus. *A. mearnsii* is known as “Acacia-Negra” or Black Wattle [95]. Smooth bark, spherical heads, and bipinnate leaves of pale yellow or cream-colored flowers with black to reddish brown pods are the distinguishing features of this upright tree. Spreading Shrub *Acacia mearnsii* usually reaches a height of 10 m (33 ft) [96, 97, 98]. *A. mearnsii* does not grow on very dry and poor. Synonyms include *Acacia decurrens* and *Racosperma mearnsii* [99, 100].

The vernacular names for the plant include-

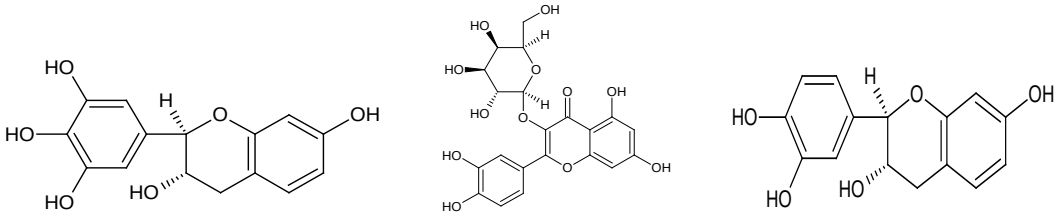
- English- black wattle
- Tamil- Chavukku

Phytochemical Analysis

Ethyl acetate extracts of Acacia mearnsii leaves contain a number of flavonoids. The main components were flavonoids, including Myricetin-O-tri-hexoside, Quercetin–O–hexoside–deoxyhexoside, Rutin, Quercetin-O-rhamnoside, Myricetin-O-pentoside, etc. The acetone fraction, L4, contained proanthocyanidins (PAC) with varying degrees of polymerization, such as (Epi)fisetinidol-(epi)fisetinidol-(epi) gallocatechin, (Epi) fisetinidol -(epi)robinetinidol-(epi) gallocatechin [101]. It was discovered that the bark of *A. mearnsii* contained a unique natural compound called robinetinidol-(4β-8)-catechin [102]. It also includes the amino acids pipecolic acid, 4-hydroxypipecolic acid, albizine, proline, arginine, aspartic acid, glutamic acid, and serine, as well as pinitol. Additionally, a long-chain β-diketone & a "steroid" alcohol have been discovered [103]. The leaves of *A. mearnsii* indicated a positive result for the presence of saponins by foaming after vigorous stirring [104]. Proanthocyanidins identified in *A. mearnsii* bark fractions (B1-B7) by LC-ESI-TOF-MSn are listed here: Procyanidin B1, Procyanidin, Gambiriin C, Cinnamtannin A2, Davallin [105].

Figure 12: *Acacia mearnsii* blossoms [26]

Compounds vanillin, p-coumaric acid, trans-cinnamic acid, 5-methylfurfural, quercetin, 4,5,7-trihydroxyflavanone, gallic acid, syringaldehyde, and caffeic acid were generally present in greater amounts in flowers of *A. mearnsii* [106]. *Acacia mearnsii* leaf hydrochloric acid extraction revealed essential and non-essential amino acids like histidine, Isoleucine, Leucine, Methionine, Threonine, Tyrosine, Alanine, Serine, Glutamine, Proline, Glycine, Arginine [107].



Robinetinidol **Quercetin 3-galactoside** **Fisetinidol**

Figure 13: Isolated compounds from *A. mearnsii*

Structure-Activity Relationship (SAR)

Robinetinidol contributes to plant defense and human health via ROS quenching, NF-κB/MAPK suppression, and cytotoxicity in cancer lines through apoptosis induction. Its pyrogallol B-ring (3',4',5'-trihydroxy) mirrors myricetin's, suggesting potent bioactivity in breast cancer models via PI3K/Akt or caspase pathways [108].

Pharmacological Activity

Table 7: Pharmacological Potential of *Acacia mearnsii*

Plant Parts	Activity	Solvent of Extraction	Ref.
Leaf	Antibacterial, Antifungal and Cytotoxicity	Acetone	107
Leaf	Antioxidant, Anti-inflammatory	80% aqueous methanol then 70% aqueous acetone	109
Leaf	Hypoglycaemic capacity, Antioxidant	80% (v/v) aqueous methanol	110
Bark	Antioxidant, Antidiabetic, Cellular Antioxidant Activity	defatted twice with hexane then suspended in 80% (v/v) ethanol	111
Bark	Inhibitory Effect on Allergic Dermatitis	Hot Water	112
Bark	Anti-tumour, Radical scavenging Activities	Water, methanol and ethanol	106
Tannins	Antimicrobial Agents	Sol-gel (SGAR, SGBR, SGSR, SGNHR) methods	113
Bark	Antimicrobial and Toxicity Activities	Acetone	114
Bark	Tyrosinase inhibitory Assay	Hot water extracts were further extracted with 70% aqueous acetone	115
Bark	Acrolein-Induced Oxidative Damage	Isolated compound robinetinidol-(4β →8)-epigallocatechin 3-O-gallate (REO)	116
Stem bark	Antibacterial Activities against Drug-Resistant Bacterial Isolates	Acetone	117
Whole plant	Antibacterial and antibiofilm activity	Commercially available tannin extract	118
Bark	Algal Bloom Control and Plankton Structure Optimization	Water	119
Bark	Inhibitory mechanisms on Microcystis aeruginosa	Water	120
Stem bark	Antimycotic and cytotoxic potentials	Methanol	121
Pods	Antioxidant, Antimicrobial	Ethanol	122

Pharmacokinetics of Acacia extracts

Catechins, epicatechins, and proanthocyanidins are examples of polyphenols and tannins found in Acacia extracts that undergo substantial phase II metabolism in the liver and stomach, producing conjugates that lower systemic levels. Poor solubility, quick breakdown in gastrointestinal disorders, and restricted absorption—only monomers, dimers, and trimers frequently make it to serum fractions—are the causes of low bioavailability. These factors make therapeutic dosing more difficult by causing low plasma levels and short half-lives [123]. Due to enterohepatic conjugation, flavonoids such as ellagic acid, kaempferol, and quercetin have poor oral bioavailability; however, ester derivatives may improve it. Although intestinal absorption is still constrained by polyphenolic complexity, gastric stability is quite good. The lack of comprehensive pharmacokinetic data indicates a gap in the literature.

Future Perspective

Variability in plant material (bark, leaves, gum), solvents, and extraction techniques such as maceration or Soxhlet extraction leads to variability in extracts, resulting in varying amounts of bioactive compounds like flavonoids and polyphenols. Reproducibility deteriorates in the absence of standardized methods, impeding clinical translation and regulatory approval for applications such as cytotoxic medicines against cancer cell lines. Current research frequently lacks quantitative HPLC/UV standards specific to these species as well as approved indicators (such as quercetin and catechin. With limited data on heavy metals, pesticides, and dose-dependent toxicity in extracts from *A. nilotica* or *A.* ferruginea—all crucial for Good Manufacturing Practices (GMP)—the safety profiles remain poorly understood. The bioavailability and stability of chemicals such as tannins in *A. catechu* for oral or topical preparations are not addressed by the limited pharmacokinetic investigations. Pharmaceuticals targeting oxidative stress in cancer models cannot be produced at scale due to the paucity of clinical trials, which are primarily preclinical. As indicated by numerous literature reviews, Acacia species are rich in medicinal properties and are also utilized in traditional remedies, according to the material gathered for this review. These days, individuals are driven to plant-based medications since they are less toxic and more economical. The development of new herbal remedies for human usage might

benefit from further investigation on these species. To fingerprint marker chemicals in Acacia extracts while maintaining batch consistency, we must develop species-specific HPTLC or LC-MS methods. connect ethnomedicine to GMP-compliant products by giving priority to *in vivo* efficacy trials and ADME analysis for *A. nilotica* polyphenols in breast cancer xenografts. In semi-arid areas, collaborative agroforestry could alleviate environmental heterogeneity by standardizing supply [123].

CONCLUSION

Therefore, most potential diseases and health issues can be treated by these Acacia species. Antimicrobial, antidiabetic, antiarthritic, anti-depression, anti-inflammatory, antioxidant, anticancer, and wound-healing properties are all exhibited by *Acacia* species. To determine acceptable therapeutic dosages, identify potential organ toxicities associated with the polyphenolic and tannin content of Acacia species, and facilitate clinical implementation amid expanding traditional use, a toxicological study of these species is crucial. Without this, issues such as hepatotoxicity at higher doses are not assessed, compromising patient safety and regulatory approval. Bioactive substances in acacia extracts, such as flavonoids and tannins, exhibit both pro-oxidant and antioxidant properties, which may lead to oxidative stress or elevated liver and kidney enzymes (e.g., ALT/AST) after prolonged exposure. Standardized acute, subacute, and chronic investigations are required in accordance with OECD rules because variations in plant parts, extraction solvents, and adulteration increase the hazards of toxicity. Acute toxicity tests of the aqueous extract of Acacia nilotica root in mice showed no mortality up to 2000 mg/kg (LD50 >5000 mg/kg) and no behavioral changes. Despite the prevalence of ethnomedicine, there are still gaps in human data, particularly for vulnerable populations like pregnant women or individuals with liver disorders [124]. The LD50 values are as follows-

***Acacia nilotica*:** No mortality up to 2000 mg/kg; oral LD50 >5000 mg/kg in mice (aqueous root extract, acute toxicity per OECD 423).

***Acacia auriculiformis*:** With no oral dose data available, it is categorized as mildly poisonous. In mice, the intraperitoneal LD50 (ethanolic leaf extract) was 3741.7 mg/kg.

Acacia catechu: Cosmetic extracts have minimal tendency to cause irritation, but no systemic oral LD50 has been identified. To aid the future development of innovative medications, further scientific research into the toxicological effects of these Acacia species is needed. Identification of active constituents, more in-depth ex vivo/in situ experiments, and, eventually, clinical trials should be conducted on the most promising plant extracts and/or pure compounds identified therein.

ACKNOWLEDGEMENT

The authors would like to thank Ms. Ritwika Sit and Ms. Sneha Paul, for partial data curation.

FINANCIAL ASSISTANCE

NIL

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTION

Conceptualization, methodology, and thorough analysis were carried out by Shreetama Roy. An investigation was conducted by Shreetama Roy, Amrita Ghosh, and Milan Jana. The original draft of the manuscript was prepared by Shreetama Roy. Writing activities, including manuscript development, were contributed to by Shreetama Roy, Amrita Ghosh, and Milan Jana. Reviewing and editing of the manuscript were undertaken by Shreetama Roy, Jyochhana Priya Mohanty, and Nihar Ranjan Bhuyan. All authors contributed substantially to the work and approved the final version of the manuscript.

REFERENCES

[1] Maslin BR, Miller JT, Seigler DS. Overview of the generic status of Acacia (Leguminosae: Mimosoideae). *Aust. Systematic Bot.*, **16**, 1–18 (2003) https://doi.org/10.1071/sb02008.

[2] Murphy DJ. A review of the classification of Acacia (Leguminosae, Mimosoideae). *Muelleria: An Australian Journal of Botany*, **26**, 10–26 (2008) https://doi.org/10.5962/p.292490.

[3] Beech E, Rivers M, Oldfield S, Smith PP. GlobalTreeSearch: The first complete global database of tree species and country distributions. *Journal of Sustainable Forestry*, **36**, 454–89 (2017) https://doi.org/10.1080/10549811.2017.1310049.

[4] Duan L, Su C, Wen J, Ji Y-W, Jiang Y, Zhang T, Charboneau JLM, Fu L, Yi Q-F, Wang F-G, Tu T-Y, Li S-J, Jiang K-W, Fang Y-H, Chen H-F. New insights into the phylogenetic relationships of tribe Astragaleae (Fabaceae subfamily Papilionoideae) and Astragalus—the largest genus of angiosperm. *Biological Diversity*, **1**, 136–46 (2024) https://doi.org/10.1002/bod2.12021.

[5] Gomes G da S, Silva GS, Silva DL dos S, Oliveira RR de, Conceição GM da. Botanical Composition of Fabaceae Family in the Brazilian Northeast, Maranhão, Brazil. *Asian Journal of*

Environment & Ecology, 1–10 (2018) https://doi.org/10.9734/AJEE/2018/41207.

[6] Dey A, De JN. Traditional Use of Plants Against Snakebite in Indian Subcontinent: A Review of the Recent Literature. *Afr J Tradit Complement Altern Med*, **9**, 153–74 (2011) https://doi.org/10.4314/ajtcam.v9i1.20.

[7] Roy S, Das R, Mohanty J, Bhuyan N. Phytochemical Profiling and Therapeutic Potential of Acacia sinuata (Lour.) Merr.: Insights into In Vitro Haemolytic, Antioxidant and Cytotoxic Activities. *Journal of Natural Remedies*, **25**, 121–32 (2025) https://doi.org/10.18311/jnr/2025/45067.

[8] Madjid O. A, Sanni A, Lagnika L. Chemical Diversity and Pharmacological Properties of Genus Acacia. *Asian J. of Applied Sciences*, **13**, 40–59 (2020) https://doi.org/10.3923/ajaps.2020.40.59.

[9] Batiha GE-S, Akhtar N, Alsayegh AA, Abusudah WF, Almohmadi NH, Shaheen HM, Singh TG, De Waard M. Bioactive Compounds, Pharmacological Actions, and Pharmacokinetics of Genus Acacia. *Molecules*, **27**, 7340 (2022) https://doi.org/10.3390/molecules27217340.

[10] Hu Y-W, Liu C-Y, Du C-M, Zhang J, Wu W-Q, Gu Z-L. Induction of apoptosis in human hepatocarcinoma SMMC-7721 cells *in vitro* by flavonoids from *Astragalus complanatus*. *Journal of Ethnopharmacology*, **123**, 293–301 (2009) https://doi.org/10.1016/j.jep.2009.03.016.

[11] Akapo CSO, Mametja NM, Ramadwa TE, Ngwangwa H, Nemavhola F, Pandelani T, Opoku AR, Masebe TM. Review of ethnopharmacology, phytochemistry, pharmacology, and toxicity of *Vachellia* (*Acacia*) species in eastern and southern Africa. *South African Journal of Botany*, **185**, 468–94 (2025) https://doi.org/10.1016/j.sajb.2025.07.051.

[12] Salem MM, Davidorf FH, Abdel-Rahman MH. In vitro anti-uveal melanoma activity of phenolic compounds from the Egyptian medicinal plant *Acacia nilotica*. *Fitoterapia*, **82**, 1279–84 (2011) https://doi.org/10.1016/j.fitote.2011.08.020.

[13] Vélez-Gavilán J. Acacia auriculiformis (northern black wattle). *CABI Compendium*, CABI Compendium, 2157 (2016) https://doi.org/10.1079/cabicompendium.2157.

[14] Al-Ghamdi AA, Tadesse Y, Adgaba N. Evaluation of major Acacia species in the nursery towards apicultural landscape restoration around Southwestern Saudi Arabia. *Saudi Journal of Biological Sciences*, **27**, 3385 (2020) https://doi.org/10.1016/j.sjbs.2020.09.002.

[15] Domínguez-Colín JA, Buendía-González L, Hernández-Jaimes C, Cruz-Sosa F, Orozco-Villafuerte J. Cytotoxic activity of callus extract from Vachellia farnesiana (L) Wight & Arn. *3 Biotech*, **14**, 235 (2024) https://doi.org/10.1007/s13205-024-04085-5.

[16] Msimango NNP, Aremu AO, Amoo SO, Masondo NA. Ethnoveterinary Potential of Acacia (Vachellia and Senegalia) Species for Managing Livestock Health in Africa: From Traditional Uses to Therapeutic Applications. *Plants (Basel)*, **14**, 3107 (2025) https://doi.org/10.3390/plants14193107.

[17] Schmerbeck J, Naudiyal N. Acacia auriculiformis. *Enzyklopädie der Holzgewächse: Handbuch und Atlas der Dendrologie*. (Stimm Bernd , Roloff Andreas , Lang Ulla M , Weisgerber Horst ed.), Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany, pp. 1–12 (2015) https://doi.org/10.1002/9783527678518.ehg2014002

[18] Mahato SB, Pal BC, Nandy AK. Structure elucidation of two acylated triterpenoid bisglycosides from cunn. *Tetrahedron*, **48**, 6717–28 (1992) https://doi.org/10.1016/S0040-4020(01)80017-X.

[19] Yoon G, Shim J-H, Kim HJ, Kim S-N, Bae M-S, Cho S-S, Kim E. Structure–activity relationship of gallic acid from Paeonia lactiflora and its synthetic analogs against human breast cancer cells. *Bulletin of the Korean Chemical Society*, **44**, 222–9 (2023) https://doi.org/10.1002/bkcs.12657.

[20] Silva MM, Santos MR, Caroço G, Rocha R, Justino G, Mira L. Structure-antioxidant activity relationships of flavonoids: a re-examination. *Free Radic Res*, **36**, 1219–27 (2002) https://doi.org/10.1080/198-1071576021000016472.

[21] Chew YL, Ling Chan EW, Tan PL, Lim YY, Stanslas J, Goh JK. Assessment of phytochemical content, polyphenolic composition, antioxidant and antibacterial activities of Leguminosae medicinal plants in Peninsular Malaysia. *BMC Complement Altern Med*, **11**, 12 (2011) https://doi.org/10.1186/1472-6882-11-12.

[22] Pennacchio M, Kemp AS, Taylor RP, Wickens KM, Kienow L. Interesting biological activities from plants traditionally used by Native Australians. *Journal of Ethnopharmacology*, **96**, 597–601 (2005) https://doi.org/10.1016/j.jep.2004.10.012.

[23] Kaur K, Arora S, Hawthorne ME, Kaur S, Kumar S, Mehta RG. A correlative study on antimutagenic and chemopreventive activity of *Acacia auriculiformis* a. cunn. and *Acacia nilotica* (l.) willd. ex del. *Drug and Chemical Toxicology*, **25(1)**, 39 – 64 (2002) https://doi.org/10.1081/DCT-100108471.

[24] Sharma A, Shetty M, Parida A, Adiga S, Kamath S, Sowjanya. Effect of ethanolic extract of Acacia auriculiformis leaves on learning and memory in rats. *Pharmacognosy Res*, **6**, 246–50 (2014) https://doi.org/10.4103/0974-8490.132605.

[25] Rangra NK, Samanta S, Pradhan KK. In vivo Antiinflammatory Potential of Leaf Extracts of Acacia auriculiformis Benth. *pharmaceutical-sciences*, **81**, (2019) https://doi.org/10.36468/pharmaceutical-sciences.562.

[26] "India Flora Online".: <https://indiaflora-ces.iisc.ac.in/herbsheet.php?id=57&cat=13>, cited 30 December, 2025.

[27] Shen D, Wu Q, Wang M, Yang Y, Lavoie EJ, Simon JE. Determination of the Predominant Catechins in Acacia catechu by Liquid Chromatography/Electrospray Ionization−Mass

Spectrometry. *J. Agric. Food Chem.*, **54**, 3219–24 (2006) https://doi.org/10.1021/jf0531499.

[28] Negi BS, Dave BP. In Vitro Antimicrobial Activity of Acacia catechu and Its Phytochemical Analysis. *Indian J Microbiol*, **50**, 369–74 (2010) https://doi.org/10.1007/s12088-011-0061-1.

[29] Kumari M, Radha, Kumar M, Zhang B, Amarowicz R, Puri S, Pundir A, Rathour S, Kumari N, Chandran D, Dey A, Sharma N, Rajalingam S, Mohankumar P, Sandhu S, Pant N, Ravichandran RP, Subramani M, Pandi K, Muthukumar M, Zengin G, Mekhemar M, Lorenzo JM. Acacia catechu (L.f.) Willd.: A Review on Bioactive Compounds and Their Health Promoting Functionalities. *Plants*, **11**, 3091 (2022) https://doi.org/10.3390/plants11223091.

[30] Baranwal A, Aggarwal P, Rai A, Kumar N. Pharmacological Actions and Underlying Mechanisms of Catechin: A Review. *Mini Rev Med Chem*, **22**, 821–33 (2022) https://doi.org/10.2174/1389557521666210902162120.

[31] Jain S, Vaidya A. Comprehensive review on pharmacological effects and mechanism of actions of taxifolin: A bioactive flavonoid. *Pharmacological Research - Modern Chinese Medicine*, **7**, 100240 (2023) https://doi.org/10.1016/j.prmcm.2023.100240.

[32] Nair A, Chattopadhyay D, Saha B. Plant-Derived Immunomodulators. *New Look to Phytomedicine*. Elsevier, pp. 435–99 (2019) https://doi.org/10.1016/B978-0-12-814619-4.00018-5

[33] Patil A, Modak M. Comparative Evaluation of Oxidative Stress Modulating and DNA Protective Activities of Aqueous and Methanolic Extracts of Acacia catechu. *Medicines*, **4**, 65 (2017) https://doi.org/10.3390/medicines4030065.

[34] Patel JD, Kumar V, Bhatt SA. Antimicrobial screening and phytochemical analysis of the resin part of Acacia catechu. *Pharmaceutical Biology*, **47(1)**, 34–37 (2009) https://doi.org/10.1080/13880200802400527.

[35] Waseem U, Jafri SR, Khalid S, Qureshi F, Majeed N, Akif U. Anti-inflammatory activity of acacia catechu-bark aqueous solution in aspirin induced gastric ulcer in rodents. *International Journal Of Community Medicine And Public Health*, **8**, 5649–54 (2021) https://doi.org/10.18203/2394-6040.ijcmph20214551.

[36] Jyoti, Garg V. *Acacia catechu* Willd. and *Acacia arabica* Willd. decrease the extent of anxiety behavior by reducing oxidative stress and moderating neurochemicals. *Journal of Ethnopharmacology*, **312**, 116496 (2023) https://doi.org/10.1016/j.jep.2023.116496.

[37] Ray D, Sharatchandra K, Thokchom IS. Antipyretic, antidiarrhoeal, hypoglycaemic and hepatoprotective activities of ethyl acetate extract of Acacia catechu Willd. in albino rats. *Indian Journal of Pharmacology*, **38**, 408 (2006) https://doi.org/10.4103/0253-7613.28207.

[38] Lakshmi T, Ramasamy R, Thirumalaikumaran R, Thirumalaikumaran R. Preliminary Phytochemical analysis and In vitro Antioxidant, FTIR Spectroscopy, Anti-diabetic activity of Acacia catechu ethanolic seed extract. *Pharmacognosy Journal*, **7**, 356–62 (2015) https://doi.org/10.5530/pj.2015.6.7.

[39] Nadumane V, Nair S. Evaluation of the anticancer and cytotoxic potentials of Acacia catechu extracts in vitro. *Journal of Natural Pharmaceuticals*, **2**, 190–190 (2011) https://doi.org/10.4103/2229-5119.92857

[40] Clarke HD, Seigler DS, Ebinger JE. Acacia farnesiana (Fabaceae: Mimosoideae) and Related Species from Mexico, the Southwestern U.S., and the Caribbean. *Systematic Botany*, **14**, 549 (1989) https://doi.org/10.2307/2419000.

[41] Campos CCZ-, García-Martínez JE, Chavira JS, Valdés JAA, Morales MAM, Mellado M. Chemical composition and nutritional value of leaves and pods of Leucaena leucocephala, Prosopis laevigata and Acacia farnesiana in a xerophilous shrubland. *Emirates Journal of Food and Agriculture*, 723–30 (2020) https://doi.org/10.9755/ejfa.2020.v32.i10.2148.

[42] Zarza-Albarrán MA, Olmedo-Juárez A, Rojo-Rubio R, Mendoza-de Gives P, González-Cortazar M, Tapia-Maruri D, Mondragón-Ancelmo J, García-Hernández C, Blé-González EA, Zamilpa A. Galloyl flavonoids from *Acacia farnesiana* pods possess potent anthelmintic activity against *Haemonchus contortus* eggs and infective larvae. *Journal of Ethnopharmacology*, **249**, 112402 (2020) https://doi.org/10.1016/j.jep.2019.112402.

[43] Claudia D, Mario C-H, Arturo N, Omar Noel M-C, Antonio N, Teresa R, Zenón Gerardo L-T, Margarita D, Marsela Alejandra Á-I, Yessica Rosalina C, Vanessa S-Q, Francisco Enrique G, Torre-Villalvazo I, Janette F, María Del Rayo C-C, José P-C. Phenolic Compounds in Organic and Aqueous Extracts from Acacia farnesiana Pods Analyzed by ULPS-ESI-Q-oa/TOF-MS. In Vitro Antioxidant Activity and Anti-Inflammatory Response in CD-1 Mice. *Molecules*, **23**, 2386 (2018) https://doi.org/10.3390/molecules23092386.

[44] Ramli S, Harada K, Ruangrungsi N. Antioxidant, Antimicrobial and Cytotoxicity Activities of *Acacia farnesiana* (L.) Willd. Leaves Ethanolic Extract. *Pharmacognosy Journal*, **3**, 50–8 (2011) https://doi.org/10.5530/pj.2011.23.8.

[45] Han G, Lee DG. Antibacterial Mode of Action of β-Amyrin Promotes Apoptosis-Like Death in Escherichia coli by Producing Reactive Oxygen Species. *J Microbiol Biotechnol*, **32**, 1547–52 (2022) https://doi.org/10.4014/jmb.2209.09040.

[46] Mlala S, Oyedeji AO, Gondwe M, Oyedeji OO. Ursolic Acid and Its Derivatives as Bioactive Agents. *Molecules*, **24**, 2751 (2019) https://doi.org/10.3390/molecules24152751.

[47] Hernández-García E, García A, Garza-González E, Avalos-Alanís FG, Rivas-Galindo VM, Rodríguez-Rodríguez J, Alcantar-Rosales VM, Delgadillo-Puga C, del Rayo Camacho-Corona M. Chemical composition of *Acacia farnesiana* (L) wild

fruits and its activity against *Mycobacterium tuberculosis* and dysentery bacteria. *Journal of Ethnopharmacology*, **230**, 74–80 (2019) https://doi.org/10.1016/j.jep.2018.10.031.

[48] Leal LSS, Silva RO, Araujo TSL, Silva VG, Barbosa ALR, Medeiros JVR, Oliveira JS, Ventura CA. The anti-inflammatory and antinociceptive effects of proteins extracted from *Acacia farnesiana* seeds. *Rev. bras. plantas med.*, **18**, 38–47 (2016) https:/doi.org/10.1590/1983-084X/15_018.

[49] Yallappa S, Manjanna J, Peethambar SK, Rajeshwara AN, Satyanarayan ND. Green Synthesis of Silver Nanoparticles Using Acacia farnesiana (Sweet Acacia) Seed Extract Under Microwave Irradiation and Their Biological Assessment. *J Clust Sci*, **24**, 1081–92 (2013) https://doi.org/10.1007/s10876-013-0599-7.

[50] H Saleema N, R Abdelhalimb A, M Alghou A, H. Abdel-Rhman S. In-vitro antimicrobial activity of Acacia farnesiana & Rosmarinus officinalis crude extract and isolated compounds against foodborne pathogens. *IJMSSSR*, **05**, 420–6 (2023) https://doi.org/10.56293/IJMSSSR.2022.4653.

[51] Delgadillo Puga C, Cuchillo Hilario M, Espinosa Mendoza JG, Medina Campos O, Molina Jijón E, Díaz Martínez M, Álvarez Izazaga MA, Ledesma Solano JÁ, Pedraza Chaverri J. Antioxidant activity and protection against oxidative-induced damage of Acacia shaffneri and Acacia farnesiana pods extracts: in vitro and in vivo assays. *BMC Complement Altern Med*, **15**, 435 (2015) https://doi.org/10.1186/s12906-015-0959-y.

[52] Cariño-Cervantes YY, Guevara-Cruz M, Medina-Campos ON, Pedraza-Chaverri J, Castillo-Martínez L, Ramírez V, Montaño-Benavidez S, Martagón AJ, Almeda-Valdes P, Cisneros-Zevallos L, Aguilar-Salinas CA, Delgadillo-Puga C. Pilot Trial of Vachellia farnesiana Pod Polyphenol Extract: Feasibility, Acute Postprandial Glycemic Response, and Incretin Hormone Modulation in Healthy Adults. *Current Developments in Nutrition*, **10**, 107670 (2026) https://doi.org/10.1016/j.cdnut.2026.107670.

[53] Faujdar S, Sati B, Sharma S, Pathak AK, Paliwal SK. Phytochemical evaluation and anti-hemorrhoidal activity of bark of *Acacia ferruginea* DC. *Journal of Traditional and Complementary Medicine*, **9**, 85–9 (2019) https://doi.org/10.1016/j.jtcme.2018.02.003.

[54] Jeevitha M, Ravi PV, Subramaniyam V, Pichumani M, Sripathi SK. Exploring the phyto- and physicochemical evaluation, fluorescence characteristics, and antioxidant activities of Acacia ferruginea Dc: an endangered medicinal plant. *Futur J Pharm Sci*, **7**, 228 (2021) https://doi.org/10.1186/s43094-021-00375-4.

[55] Faujdar S, Sharma S, Sati B, Pathak AK, Paliwal SK. Comparative analysis of analgesic and anti-inflammatory activity of bark and leaves of *Acacia ferruginea* DC. *Beni-Suef University Journal of Basic and Applied Sciences*, **5**, 70–8 (2016) https://doi.org/10.1016/j.bjbas.2016.02.002.

[56] Sakthivel KM, Guruvayoorappan C. *Acacia ferruginea* inhibits inflammation by regulating inflammatory iNOS and COX-2. *Journal of Immunotoxicology*, **13**, 127–35 (2016) https://doi.org/10.3109/1547691X.2015.1017625.

[57] Deb J, Singh A, Rathore DS, Dash GK, Deb NK. Studies on antidiabetic activity of Acacia ferruginea DC. stem bark. *IJPBR*, **3**, 11–5 (2015) https://doi.org/10.30750/ijpbr.3.4.3.

[58] Sowndhararajan K, Kang SC. Protective effect of ethyl acetate fraction of *Acacia ferruginea* DC. against ethanol-induced gastric ulcer in rats. *Journal of Ethnopharmacology*, **148**, 175–81 (2013) https://doi.org/10.1016/j.jep.2013.04.007.

[59] Sakthivel KM, Guruvayoorappan C. Acacia ferruginea inhibits tumor progression by regulating inflammatory mediators-(TNF-a, iNOS, COX-2, IL-1β, IL-6, IFN-γ, IL-2, GM-CSF) and pro-angiogenic growth factor- VEGF. *Asian Pac J Cancer Prev*, **14**, 3909–19 (2013) https://doi.org/10.7314/apjcp.2013.14.6.3909.

[60] Sakthivel KM, Guruvayoorappan C. Protective Effect of *Acacia ferruginea* against Ulcerative Colitis via Modulating Inflammatory Mediators, Cytokine Profile and NF-κB Signal Transduction Pathways. *JEP(T)*, **33**, (2014) https://doi.org/10.1615/JEnvironPatholToxicolOncol.2014008425.

[61] Sowndhararajan K, Hong S, Jhoo J-W, Kim S, Chin NL. Effect of acetone extract from stem bark of *Acacia* species (*A. dealbata*, *A. ferruginea* and *A. leucophloea*) on antioxidant enzymes status in hydrogen peroxide-induced HepG2 cells. *Saudi Journal of Biological Sciences*, **22**, 685–91 (2015) https://doi.org/10.1016/j.sjbs.2015.03.010.

[62] M J, Ravi PV, Subramaniyam V, Pichumani M, Sripathi SK. Biomimetic syntheses of silver nanoparticles using A. ferruginea bark extracts and tenable approaches for developing anti-infectives. *Appl Nanosci*, **12**, 2579–94 (2022) https://doi.org/10.1007/s13204-022-02570-y.

[63] Afsar T, Razak S, Aldisi D, Shabbir M, Almajwal A, Al Kheraif AA, Arshad M. Acacia hydaspica R. Parker ethyl-acetate extract abrogates cisplatin-induced nephrotoxicity by targeting ROS and inflammatory cytokines. *Sci Rep*, **11**, 17248 (2021) https://doi.org/10.1038/s41598-021-96509-y.

[64] Afsar T, Razak S, Khan MR, Mawash S, Almajwal A, Shabir M, Haq IU. Evaluation of antioxidant, anti-hemolytic and anticancer activity of various solvent extracts of Acacia hydaspica R. Parker aerial parts. *BMC Complementary and Alternative Medicine*, **16**, 258 (2016) https://doi.org/10.1186/s12906-016-1240-8.

[65] Afsar T, Razak S, Shabbir M, Khan MR. Antioxidant activity of polyphenolic compounds isolated from ethyl-acetate fraction of Acacia hydaspica R. Parker. *Chemistry Central Journal*, **12**, 5 (2018) https://doi.org/10.1186/s13065-018-0373-x.

[66] Chhillar R, Dhingra D. Antidepressant-like activity of gallic acid in mice subjected to unpredictable chronic mild stress.

Fundamemntal Clinical Pharma, **27**, 409–18 (2013) https://doi.org/10.1111/j.1472-8206.2012.01040.x.

[67] Afsar T, Razak S, Almajwal A. Reversal of cisplatin triggered neurotoxicity by Acacia hydaspica ethyl acetate fraction via regulating brain acetylcholinesterase activity, DNA damage, and pro-inflammatory cytokines in the rodent model. *BMC Complement Med Ther*, **22**, 179 (2022) https://doi.org/10.1186/s12906-022-03657-3.

[68] Afsar T, Razak S, Khan MR, Almajwal A. Anti-depressant and anxiolytic potential of Acacia hydaspica R. Parker aerial parts extract: Modulation of brain antioxidant enzyme status. *BMC Complement Altern Med*, **17**, 228 (2017) https://doi.org/10.1186/s12906-017-1671-x.

[69] Baishya D, Choudhury A, Deka H, Hoque N, Jyrwa R, Sarmah J. Preparation of Herbal Hair Oil Exploring the Therapeutic Benefits of Herbs and Its Evaluation. *J. Appl. Pharm. Res.*, **12**, 116–27 (2024) https://doi.org/10.18231/j.joapr.2024.12.1.116.127.

[70] Cheng M-C, Lu Y-C, Wu J, Ma Y-H. Gallate-induced nanoparticle uptake by tumor cells: Structure-activity relationships. *Colloids Surf B Biointerfaces*, **179**, 28–36 (2019) https://doi.org/10.1016/j.colsurfb.2019.03.048.

[71] Afsar T, Razak S, Almajwal A, Shabbir M, Khan MR. Evaluating the protective potency of Acacia hydaspica R. Parker on histological and biochemical changes induced by Cisplatin in the cardiac tissue of rats. *BMC Complement Altern Med*, **19**, 182 (2019) https://doi.org/10.1186/s12906-019-2575-8.

[72] Foyzun T, Mahmud AA, Ahammed MS, Manik MIN, Hasan MK, Islam KM, Lopa SS, Al-Amin MY, Biswas K, Afrin MR, et al. Polyphenolics with Strong Antioxidant Activity from *Acacia nilotica* Ameliorate Some Biochemical Signs of Arsenic-Induced Neurotoxicity and Oxidative Stress in Mice. *Molecules*. 2022; 27(3):1037. https://doi.org/10.3390/molecules27031037

[73] Amit Kumar, Sushil Kumar, Mukesh Kr Singh, Sunil Kumar Tiwari, A comprehensive review on the chemical composition and pharmacological activities of ACACIA ARABICA, Intelligent Pharmacy, 5, (2024), https://doi.org/10.1016/j.ipha.2024.01.008.

[74] Dogara AM, Hama HA, Ozdemir M. Biological evaluation of Acacia nilotica (L.) Willd. ex Delile: a systematic review. *ADV TRADIT MED (ADTM)*, **24**, 1–39 (2024) https://doi.org/10.1007/s13596-023-00683-5.

[75] Hafez LO, Brito-Casillas Y, Abdelmageed N, Alemán-Cabrera IM, Morad SAF, Abdel-Raheem MH, Wägner AM. The Acacia (Vachellia nilotica (L.) P.J.H. Hurter & Mabb.): Traditional Uses and Recent Advances on Its Pharmacological Attributes and Potential Activities. *Nutrients*, **16**, 4278 (2024) https://doi.org/10.3390/nu16244278.

[76] Gadilohar NR, Girase AM, Suryawanshi HP, Pawar SP. A Descriptive Study of *Acacia nilotica* Linn. *Asian Jour. Pharmac. Rese.*, **8**, 170 (2018) https://doi.org/10.5958/2231-5691.2018.00030.8.

[77] Abbasian K, Asgarpanah J, Ziarati P. Chemical Composition profile of Acacia nilotica Seed Growing Wild in South of Iran. *Orient. J. Chem*, **31**, 1027–33 (2015) https://doi.org/10.13005/ojc/310251.

[78] Chaubal R, Pawar PV, Hebbalkar GD, Tungikar VB, Puranik VG, Deshpande VH, Deshpande NR. Larvicidal Activity ofAcacia nilotica Extracts and Isolation ofD-Pinitol - A Bioactive Carbohydrate. *C&B*, **2**, 684–8 (2005) https://doi.org/10.1002/cbdv.200590044.

[79] Sundarraj S, Thangam R, Sreevani V, Kaveri K, Gunasekaran P, Achiraman S, Kannan S. γ-Sitosterol from *Acacia nilotica* L. induces G2/M cell cycle arrest and apoptosis through c-Myc suppression in MCF-7 and A549 cells. *Journal of Ethnopharmacology*, **141**, 803–9 (2012) https://doi.org/10.1016/j.jep.2012.03.014.

[80] Rehman NU, Ansari MN, Ahmad W, Amir M. GC–MS Analysis and In Vivo and Ex Vivo Antidiarrheal and Antispasmodic Effects of the Methanolic Extract of Acacia nilotica. *Molecules*, **27**, 2107 (2022) https://doi.org/10.3390/molecules27072107.

[81] Kaur P, Arora S, Singh R. Isolation, characterization and biological activities of betulin from Acacia nilotica bark. *Sci Rep*, **12**, 9370 (2022) https://doi.org/10.1038/s41598-022-13338-3.

[82] Zheleva-Dimitrova D, Sinan KI, Etienne OK, Ak G, Sharmeen JB, Dervisoglu G, Ozdemir FA, Mahomoodally MF, Zengin G. Comprehensive chemical characterization and biological evaluation of two *Acacia* species: *A. nilotica* and *A. ataxacantha*. *Food and Chemical Toxicology*, **156**, 112446 (2021) https://doi.org/10.1016/j.fct.2021.112446.

[83] Alambayan J, Vats M, Sood P, Kaur G, Khan H, Devi S. Antiulcer and antioxidant activity of Acacia arabica extract in alcohol and NSAIDS-induced gastric injury in animal model. *Comp Clin Pathol*, **33**, 823–35 (2024) https://doi.org/10.1007/s00580-024-03600-7.

[84] Baishya D, Choudhury A, Deka H, Hoque N, Jyrwa R, Sarmah J. Preparation of Herbal Hair Oil Exploring the Therapeutic Benefits of Herbs and Its Evaluation. *J. Appl. Pharm. Res.*, **12**, 116–27 (2024) https://doi.org/10.18231/j.joapr.2024.12.1.116.127.

[85] Ansari P, Islam SS, Akther S, Khan JT, Shihab JA, Abdel-Wahab YHA. Insulin secretory actions of ethanolic extract of *Acacia arabica* bark in high fat-fed diet-induced obese Type 2 diabetic rats. *Bioscience Reports*, **43**, BSR20230329 (2023) https://doi.org/10.1042/BSR20230329.

[86] Alduraihem NS, Bhat RS, Al-Zahrani SA, Elnagar DM, Alobaid HM, Daghestani MH. Anticancer and Antimicrobial Activity of Silver Nanoparticles Synthesized from Pods of Acacia nilotica. *Processes*, **11**, 301 (2023) https://doi.org/10.3390/pr11020301.

[87] Adepoju FO, Duru KC, Li E, Kovaleva EG, Tsurkan MV. Pharmacological Potential of Betulin as a Multitarget Compound. *Biomolecules*, **13**, 1105 (2023) https://doi.org/10.3390/biom13071105.

[88] Andhare A, Bharambe S, Pawar A, Sutar D. Antimicrobial Sensitivity of Plant Extracts of Acacia arabica, Prosopis juliflora, Abutilon indicum, and Bryonia laciniosa on Staphylococcus aureus, Pseudomonas aeruginosa, and Escherichia coli. *Qeios*, (2023) https://doi.org/10.32388/HMXWSL.

[89] Hassan AU, Garba S, Fatima Y, Aliyu F, Kereakede E, Ada IO. *in vivo* Antibacterial Activity of *Acacia nilotica* Phenolics Against Extreme Multidrug Resistant *Pseudomonas aeruginosa* Strains. *USci*, **5**, 212–28 (2026) https://doi.org/10.56919/usci.2651.018.

[90] Ali R, Tabrez S, Rahman F, Alouffi AS, Alshehri BM, Alshammari FA, Alaidarous MA, Banawas S, Dukhyil AAB, Rub A. Antileishmanial Evaluation of Bark Methanolic Extract of *Acacia nilotica* : *In Vitro* and *In Silico* Studies. *ACS Omega*, **6**, 8548–60 (2021) https://doi.org/10.1021/acsomega.1c00366.

[91] Omara EA, Nada SA, Farrag ARH, Sharaf WM, El-Toumy SA. Therapeutic effect of *Acacia nilotica* pods extract on streptozotocin induced diabetic nephropathy in rat. *Phytomedicine*, **19**, 1059–67 (2012) https://doi.org/10.1016/j.phymed.2012.07.006.

[92] Manoharan J, Chinnakannu NK, Ranganathan B. Phytochemical screening, Antiradical and Anti-inflammatory activity of aqueous bark extract acquired from Acacia nilotica. *Research Journal of Pharmacy and Technology*, **16**, 4831–5 (2023) https://doi.org/10.52711/0974-360X.2023.00783.

[93] Safari VZ, Kamau JK, Nthiga PM, Ngugi MP, Orinda G, Njagi EM. Antipyretic, Antiinflammatory and Antinociceptive Activities of Aqueous Bark Extract of Acacia Nilotica (L.) Delile in Albino Mice. *Journal of Pain Management & Medicine*, **2**, 1–7 (2016) https://doi.org/10.35248/2684-1320.16.2.113.

[94] Rauf A, Ibrahim M, Alomar TS, AlMasoud N, Khalil AA, Khan M, Khalid A, Jan MS, Formanowicz D, Quradha MM. Hypoglycemic, anti-inflammatory, and neuroprotective potentials of crude methanolic extract from *Acacia nilotica* L. – results of an in vitro study. *Food Science & Nutrition*, **12**, 3483–91 (2024) https://doi.org/10.1002/fsn3.4017.

[95] Sadiq MB, Tharaphan P, Chotivanich K, Tarning J, Anal AK. In vitro antioxidant and antimalarial activities of leaves, pods and bark extracts of Acacia nilotica (L.) Del. *BMC Complement Altern Med*, **17**, 372 (2017) https://doi.org/10.1186/s12906-017-1878-x.

[96] Mwangengwa LM, Bakari GG, Kanuya NL, Max RA. Antifertility effects of crude extracts from Acacia nilotica pods and Albizia lebbeck stem bark in female multimammate rats, Mastomys natalensis. *JPAP*, **12**, 1–10 (2021) https://doi.org/10.5897/JPAP2021.0137.

[97] Richardson DM, Binggeli P, Botella C. Australian *Acacia* Species in Africa. *Wattles*. (Richardson David M , Roux Johannes J Le , Marchante Elizabete ed.), CABI, GB, pp. 181–200 (2023) https://doi.org/10.1079/9781800622197.0012

[98] Mengistu AG, Tesfuhuney WA, Woyessa YE, Steyn AS. Potential distribution of selected invasive alien plants under current and future climate change scenarios in South Africa. *Heliyon*, **9**, (2023) https://doi.org/10.1016/j.heliyon.2023.e19867.

[99] Giri S, Sahu R, Paul P, Nandi G, Dua TK. An updated review on *Eupatorium adenophorum* Spreng. : traditional uses, phytochemistry, pharmacological activities and toxicity. *Pharmacological Research - Modern Chinese Medicine*, **2**, 100068 (2022) https://doi.org/10.1016/j.prmcm.2022.100068.

[100] MacKenzie AM. The flavonoids of the leaves of Acacia mearnsii. *Phytochemistry*, **8**, 1813–5 (1969) https://doi.org/10.1016/S0031-9422(00)85974-9.

[101] Roux DG. Recent advances in the chemistry and chemical utilization of the natural condensed tannins. *Phytochemistry*, **11**, 1219–30 (1972) https://doi.org/10.1016/S0031-9422(00)90068-2.

[102] Saayman HM, Roux DG. The origins of tannins and flavonoids in black-wattle barks and heartwoods, and their associated “non-tannin” components. *Biochem J*, **97**, 794–801 (1965) https://doi.org/10.1042/bj0970794.

[103] Xiong J, Grace MH, Esposito D, Komarnytsky S, Wang F, Lila MA. Polyphenols isolated from Acacia mearnsii bark with anti-inflammatory and carbolytic enzyme inhibitory activities. *Chin J Nat Med*, **15**, 816–24 (2017) https://doi.org/10.1016/S1875-5364(18)30015-3.

[104] Uushona T, Chikwanha OC, Tayengwa T, Katiyatiya CLF, Strydom PE, Mapiye C. Nutraceutical and preservative potential of *Acacia mearnsii* and *Acacia dealbata* leaves for ruminant production and product quality enhancement. *J. Agric. Sci.*, **159**, 743–56 (2021) https://doi.org/10.1017/S0021859621001015.

[105] Olajuyigbe OO, Afolayan AJ. In vitro antibacterial and time-kill assessment of crude methanolic stem bark extract of Acacia mearnsii de wild against bacteria in shigellosis. *Molecules*, **17**, 2103–18 (2012) https://doi.org/10.3390/molecules17022103.

[106] Xiong J, Grace MH, Esposito D, Wang F, Lila MA. Phytochemical characterization and anti-inflammatory properties of Acacia mearnsii leaves. *Natural Product Communications*, **11**, 649–53 (2016) https://doi.org/10.1177/1934578x1601100524 .

[107] Wu C, He L, Zhang Y, You C, Li X, Jiang P, Wang F. Separation of flavonoids with significant biological activity from Acacia mearnsii leaves. *RSC Advances*, **13**, 9119–27 (2023) https://doi.org/10.1039/D3RA00209H.

[108] Shen X, Wang Y, Wang F. Characterisation and biological activities of proanthocyanidins from the barks of *Pinus massonian* and *Acacia mearnsii*. *Natural Product Research*, **24**, 590–8 (2010) https://doi.org/10.1080/14786410903194472.

[109] Chen X, Xiong J, He L, Zhang Y, Li X, Zhang L, Wang F. Effects of In Vitro Digestion on the Content and Biological Activity of Polyphenols from Acacia mearnsii Bark. *Molecules*, **23**, 1804 (2018) https://doi.org/10.3390/molecules23071804.

[110] Jakimiuk K. A Comprehensive Review of Robinetin: Distribution, Biological Activity and Pharmacokinetic Parameters. *International Journal of Molecular Sciences*, **26**, 9546 (2025) https://doi.org/10.3390/ijms26199546.

[111] Avoseh ON, Oyedeji OO, Aremu K, Nkeh-Chungag BN, Songca SP, Oluwafemi SO, Oyedeji AO. Chemical composition and anti-inflammatory activities of the essential oils from *Acacia mearnsii* de Wild. *Natural Product Research*, **29**, 1184–8 (2015) https://doi.org/10.1080/14786419.2014.983504.

[112] Avoseh ON, Oyedeji OO, Aremu O, Nkeh-Chungag BN, Songca SP, Oyedeji AO, Mohan S, Oluwafemi OS. Biosynthesis of silver nanoparticles from *Acacia mearnsii* De Wild stem bark and its antinociceptive properties. *Green Chemistry Letters and Reviews*, **10**, 59–68 (2017) https://doi.org/10.1080/17518253.2017.1287310.

[113] Chen X, Xiong J, Huang S, Li X, Zhang Y, Zhang L, Wang F. Analytical Profiling of Proanthocyanidins from Acacia mearnsii Bark and In Vitro Assessment of Antioxidant and Antidiabetic Potential. *Molecules*, **23**, 2891 (2018) https://doi.org/10.3390/molecules23112891.

[114] Ikarashi N, Takeda R, Ito K, Ochiai W, Sugiyama K. The Inhibition of Lipase and Glucosidase Activities by Acacia Polyphenol. *Evidence-Based Complementary and Alternative Medicine*, **2011**, 272075 (2011) https://doi.org/10.1093/ecam/neq043.

[115] dos Santos C, Vargas Á, Fronza N, dos Santos JHZ. Structural, textural and morphological characteristics of tannins from *Acacia mearnsii* encapsulated using sol-gel methods: Applications as antimicrobial agents. *Colloids and Surfaces B: Biointerfaces*, **151**, 26–33 (2017) https://doi.org/10.1016/j.colsurfb.2016.11.041.

[116] Olajuyigbe OO, Afolayan AJ. Pharmacological Assessment of the Medicinal Potential of Acacia mearnsii De Wild.: Antimicrobial and Toxicity Activities. *IJMS*, **13**, 4255–67 (2012) https://doi.org/10.3390/ijms13044255.

[117] Takagi K, Mitsunaga T. Tyrosinase inhibitory activity of proanthocyanidins from woody plants. *J Wood Sci*, **49**, 461–5 (2003) https://doi.org/10.1007/s10086-002-0496-4.

[118] Huang W, Niu H, Xue X, Li J, Li C. Robinetinidol-(4β→8)-epigallocatechin 3-O-gallate, A Galloyl Dimer Prorobinetinidin From Acacia Mearnsii De Wild, Effectively Protects Human Neuroblastoma SH-SY5Y Cells Against Acrolein-Induced Oxidative Damage. *Journal of Alzheimer's Disease*, (2010) https://doi.org/10.3233/JAD-2010-090886

[119] Olajuyigbe OO, Coopoosamy RM. Influence of First-Line Antibiotics on the Antibacterial Activities of Acetone Stem Bark Extract of *Acacia mearnsii* De Wild. against Drug-Resistant Bacterial Isolates. *Evidence-Based Complementary and Alternative Medicine*, **2014**, 423751 (2014) https://doi.org/10.1155/2014/423751.

[120] Klug TV, Novello J, Laranja DC, Aguirre TAS, De Oliveira Rios A, Tondo EC, Santos RPD, Bender RJ. Effect of Tannin Extracts on Biofilms and Attachment of Escherichia coli on Lettuce Leaves. *Food Bioprocess Technol*, **10**, 275–83 (2017) https://doi.org/10.1007/s11947-016-1812-0.

[121] Zhou L, Bi Y, Jiang L, Wang Z, Chen W. Effect of Black Wattle (*Acacia mearnsii*) Extract on Blue-Green Algal Bloom Control and Plankton Structure Optimization: A Field Mesocosm Experiment. *Water Environment Research*, **84**, 2133–42 (2012) https://doi.org/10.2175/106143012X13418552642083.

[122] Liu Z, Zhou L, Liu D, Zhu Q, Chen W. Inhibitory mechanisms of Acacia mearnsii extracts on the growth of Microcystis aeruginosa. *Water Science and Technology*, **71**, 856–61 (2015) https://doi.org/10.2166/wst.2015.038.

[123] Olajuyigbe O, Adeoye-Isijola M, Coopoosamy R. Antimycotic and cytotoxicological potentials of Acacia mearnsii de wild. stem bark extract: In vitro assessment. *Kragujevac J Science*, 87–96 (2019) https://doi.org/10.5937/KgJSci1941087O.

[124] Pedro SI, Fernandes TA, Luís Â, Antunes AMM, Gonçalves JC, Gominho J, Gallardo E, Anjos O. First Chemical Profile Analysis of Acacia Pods. *Plants*, **12**, 3486 (2023) https://doi.org/10.3390/plants12193486.