

From Weed to Wonder: Exploring the Multifaceted Pharmacological Actions of *Tridax procumbens* Linn.

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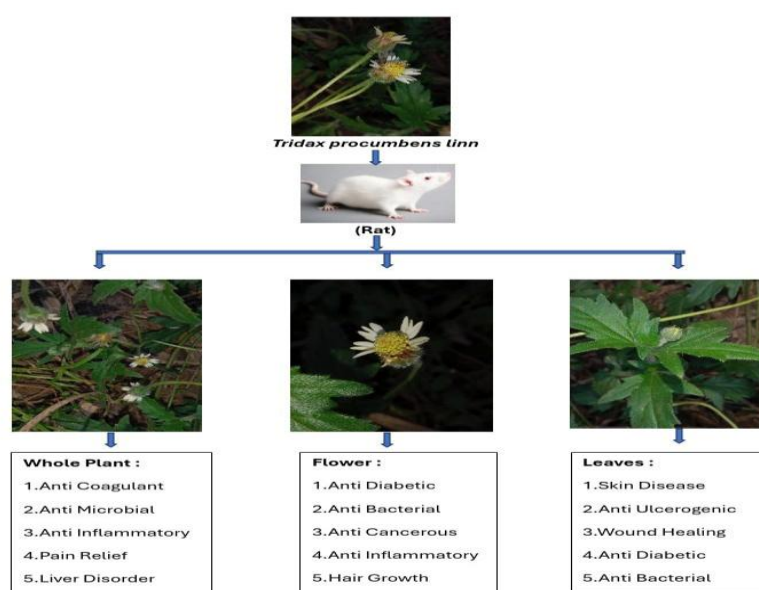
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ABSTRACT

Originally from Tropical America, *Tridax procumbens*, also known as coat buttons, is a member of the Asteraceae (Sun flower Family) and is found throughout Southeast Asia, Africa, India, and other tropical regions. Uses of the medication include anti-diabetes, antioxidants, antiarthritic, hepatoprotective, liver disorders, anticancer, wound healing, hair loss, and “Bhringraj,” which some Ayurvedic practitioners prescribe. As clinically useful medications, as building blocks for synthetic drugs, or as lead compounds from which a completely synthetic drug can be created, natural products continue to be crucial in the search and development of new pharmaceuticals. It is a tropical and subtropical herb traditionally used for its diverse medicinal benefits. This review explores the pharmacological and phytochemical profile of *Tridax procumbens*, emphasizing its therapeutic potential and scientific validation. Phytochemical analysis reveals the presence of secondary metabolites such as flavonoids, alkaloids, tannins, saponins, carotenoids, phenols, sterols (β -sitosterol, stigmasterol), oleanolic acid, and fumaric acid, and luteolin— compounds known for their strong biological activities. The wide range of bioactivities, low toxicity, and availability in tropical regions make it a valuable candidate for the development of affordable, safe, and effective plant-based therapeutics. Continued research into its phytochemistry and mechanism of action may further establish *T. procumbens* as a potential source for novel drug discovery

Keywords: Wound healing, antioxidant, anti-inflammatory, antidiabetic, antimicrobial, anti coagulant



Graphical Abstract: Pharmacological Profile of *Tridax procumbens* Linn

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INTRODUCTION

A range of therapeutic applications, such as anesthetic, anti-inflammatory, anti-diabetic, and anti-anemic qualities. This species has a long history of traditional use by different communities.

The purpose of this study was to review the scientific literature on the biological activity, medicinal qualities, and phytochemical components of *Tridax procumbens*, a member of the Central and South American-originated Asteraceae family.¹

Tridax procumbens is a promising ethnobotanical resource because it produces secondary metabolites that can be used for therapeutic or preventative purposes. Important facts about this species are presented in this review, which also suggests that it

may be a safe, effective, and reasonably priced treatment for a number of illnesses, particularly in tropical regions where it is native and widely distributed.¹

Tannins, alkaloids, saponins, flavonoids, phenols, steroids, anthocyanins, proteins, amino acids, and carbohydrates are among the many different types of secondary metabolites found in plants. These compounds have been used to make significant pharmaceutical products. The purpose of this study is to compile the scientific literature on the pharmacological significance, bioactive components, and therapeutic qualities of the plant *Tridax procumbens*, which belongs to the Asteraceae family.¹⁰



Figure 1: *Tridax procumbens* Linn

Table -01: Comprehensive Profile of *Tridax procumbens*

Vernacular names	Ghamra (Hindi), Tikke gida (Kannada), Seruppadithazhai (Tamil), Ravanasurudi talakaai (Telugu) Dagadi Pala (Marathi).
Geographical Source	Originally from the tropical Americas, <i>Tridax procumbens</i> has spread throughout tropical, subtropical, and mild temperate regions of the world. It can be found in tropical Africa, Asia, Australia, and India. In some of these regions, including the southern United States, it is now regarded as a noxious weed. Initial native range: The tropical Americas, including Mexico and Central America, are where the plant first appeared.

Chemical Components	Numerous chemical components, such as flavonoids, alkaloids, tannins, saponins, and carotenoids, are present in <i>Tridax procumbens</i> . Fatty acids, sterols like beta-sitosterol and stigma sterol, organic acids like fumaric and oleanolic acids, and a variety of minerals like calcium, iron, magnesium, sodium, and potassium are also present in the plant. Additional substances found include polysaccharides, lignans, and derivatives of benzoic acid.
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Table -2: Taxonomical information of *Tridax procumbens*

Kingdom	Plantae
Division	Angiosperms
Class	Ganglioside(Dicotyledons)
Order	Asterales
Family	Asteraceae(Compositae)
Genus	Tridax
Species	T.procumbens

PHARMACOLOGICAL ACTIVITY

Anti-Diabetic Activity

Parts Used: Whole plant

Diabetes is a metabolic disease that impacts the metabolism of proteins, fats, and carbohydrates. India is home to the common herb *Tridax procumbens* Linn. Family: Asteraceae; also known as Dhaman grass. The leaf powder, along with other herbs, is traditionally taken orally by the tribal people of Rajasthan's Udaipur district to treat diabetes. In order to provide scientific evidence for the use of this plant in traditional medicine, extracts must be evaluated.²

Method: *Tridax procumbens* whole plant extraction with 50% methanol. The extract was tested for acute toxicity in normal rats and for acute and sub-chronic anti-hyperglycemic activity in rats with diabetes induced by alloxan. Additionally, measurements of body weight and oral glucose tolerance levels were noted.²

Anti-arthritis activity:

Parts Used: Whole plant

Using the Freund's Complete Adjuvant (FCA) model, female Sprague Dawley (SD) rats were used to assess the anti-arthritis effects of an ethanolic whole plant extract of *Tridax procumbens* (Asteraceae).³

Method: The plant was gathered from various parts of Tamil Nadu's Madurai District, and chemical tests were used to determine its phytoconstituents. The entire plant was extracted using a Soxhlet extractor and 95% ethanol. For anti-arthritis screening, female SD rats were employed. FCA was used to induce arthritis, and the anti-arthritis effects of *Tridax procumbens* ethanolic extract were investigated at 250 and 500 mg/kg. The results were contrasted with those of 10 mg/kg of indomethacin. A radiological examination and liver enzyme levels were assessed at the conclusion of the study.³

Anti-inflammation activity

Method: Anti-inflammatory activity of TPC gel was assessed by bovine serum albumin (BSA) denaturation assay and egg albumin (EA) denaturation assay. Free radical scavenging activity was evaluated by DPPH (2, 2-diphenyl-1-picrylhydrazyl) assay and hydroxyl radical scavenging (H₂O₂) assay.⁴

Anti-Bacterial activity:

Parts Used: leaves

Examine pet ether, chloroform, and ethanolic extracts of *Tridax procumbens* (*Tridax procumbens*) for phytochemical screening and antibacterial activity.⁵

Method: Using the agar well diffusion method, the antibacterial activity of *Tridax procumbens* leaves was assessed against three specific gram-positive and gram-negative bacterial species.⁵

Wound Healing:

Animal: Albino Rat

Parts Used: whole plant



Albino rats were used to test the effects of *Tridax procumbens* ' whole plant extract (WPE), aqueous extract (AE), butanol fraction (BF), and petroleum ether fraction (PEF) on the healing of dead space wounds. Using granuloma tissue taken from wounds that were 10 days old, lysyl oxidase activity, tensile strength, and other biochemical parameters were estimated. Animals treated with WPE and AE showed significant increases in lysyl oxidase activity, protein and nucleic acid contents, and tensile strength. However, all of these parameters except tensile strength decreased in animals treated with BF and PEF. Hexosamine levels were elevated in these two groups ($p < 0.001$). In general, WPE appears to be more active than the other extracts.⁶

Anti-Tubercular Activity:

Parts Used: Whole Plant

The human pathogen that causes tuberculosis (TB) is *Mycobacterium tuberculosis*. The ability of traditional medicinal plants to combat human infections has been documented by researchers. Studies on medicinal plants' antimycobacterial properties against *M. tuberculosis* are still scarce, though. Characterizing *Tridax procumbens*' phytochemical profile and antibacterial and antimycobacterial activity against H37Rv is the aim of this investigation. The inhibitory zone that developed around the disc using the disk diffusion method provided insight into the antibacterial activity.⁷ The Microplate Alamar Blue Assay (MABA) measurement of *Tridax* antimycobacterial activity indicates that the sample is sensitive to H37Rv at a minimum inhibitory concentration (MIC) of 600 $\mu\text{g/mL}$. The sample is susceptible to H37Rv and resistant to rifampicin (RR), according to the BACTEC MGIT 960 DST. MTT, Fourier transform infrared spectroscopy (FTIR), and gas chromatography-mass spectrometry (GC-MS) were used to determine the antiproliferative, functional group, and mechanism of action of secondary metabolites. Molecular docking data further supports the antimycobacterial efficacy of the phytocompounds. With a binding affinity of -6.6 kcal/mol, the (S, Z)-Heptadeca-1,9-dien-4,6-diyn-3-ol molecule was identified as a prominent

phytocompound based on ligand binding interactions with the *gyrA* gene.⁷

Anti-Cancer Activity:

Parts Used: Whole Plant

The flowering plant *Tridax procumbens*, which belongs to the Asteraceae family, has many therapeutic applications, including anti-inflammatory, anti-diabetic, anti-microbial, and immunomodulatory properties. This study sought to determine whether luteolin, a phytochemical found in *Tridax procumbens*, had anti-cancerous properties against human lung cancer. The purpose of the computational study was to investigate the structural characteristics of luteolin. Through virtual screening of ADMET properties, the molecule's drug-likeness has been predicted.⁸ The in-silico method's molecular docking technique is used to verify that a complex forms between a ligand and a protein. Molecular dynamics (MD) simulations are used to study the molecule's stability and reactivity. In this study, we have attempted to demonstrate that any of the phytochemicals found in *Tridax procumbens* have a strong potential to inhibit human lung cancer.⁸

Hepatoprotective Activity:

Parts Used: Aerial Parts

The ability of *Tridax procumbens* ' aerial parts to protect rats from d-galactosamine/lipopolysaccharide (d-GalN/LPS)-induced hepatitis was examined. 300 mg/kg body weight or 30 microg/kg body weight of d-GalN/LPS A marked rise in the activities of marker enzymes (aspartate transaminase, alanine transaminase, alkaline phosphatase, lactate dehydrogenase, and gamma glutamyl transferase) as well as bilirubin levels in serum and lipids in the liver and serum were indicators of -induced hepatic damage.⁹ These changed parameters returned to normal when rats were pretreated with a chloroform-insoluble fraction from an ethanolic extract of *Tridax procumbens*. Histopathological analysis of liver sections was used to support the biochemical observations. According to the study's findings, *Tridax procumbens* may provide a substantial buffer against d-GalN/LPS-induced hepatocellular damage.⁹



Anti-Oxidant Activity

Antioxidants stop free radicals, which are molecules released during the regular metabolic process of oxidation, from causing damage to cells. Reactive oxygen free radical species (ROS), reactive hydroxyl radicals (OH.), the superoxide anion radical (O₂), hydrogen peroxides (H₂O₂), and peroxy (ROO.) are a few examples of these free radicals that produce metabolic products that target lipids in DNA or cell membranes. These contribute to heart disease and arthritis and are linked to various forms of biological damage, DNA damage, carcinogenesis, and aging-related cellular degeneration (Hou et al., 2003).¹¹ The body's unsaturated fats are shielded from oxidation by peroxides and other free radicals by antioxidants. Agents that bind free oxygen (reducing agents), like ascorbic acid (vitamin C), and agents that deactivate the enzymes¹¹

Vasorelaxation: The herb *Tridax procumbens* (Linn) belongs to the Asteraceae family and is found all over the world. In Nigeria, its leaves have long been used to treat high blood pressure. In the aortic rings isolated from normotensive rats, prior research has demonstrated that the aqueous leaves of *Tridax procumbens* extract (TPE) reduce blood pressure through both endothelium-dependent and -independent mechanisms. By evaluating its mechanistic interactions with cyclic guanosine monophosphate (cGMP), cyclic adenosine monophosphate (cAMP), and nitric oxide (NO)

synthase, the current study sought to further explore the mechanisms underlying TPE-induced relaxation in the aortic artery.¹⁵

Method: After being pre-contracted with phenylephrine (PE) (10⁻⁷ M) and KCl (60 mM), the aortic artery isolated from healthy, young adult normotensive Wistar albino rats (250–300 g) was treated with varying concentrations of TPE aqueous extract (0.5–9.0 mg/ml). The Ugo Basile model 7004 in conjunction with the data capsule acquisition system model 17400 was used to record the variations in arterial tension. It was also assessed how TPE interacted with cAMP and cGMP inhibitors.¹⁵

Anti-Hypertensive Activity:

Parts Used: Leaves

Twenty healthy, adult male rats (150–190 g) were divided into four groups of five. Group 1 (control) received normal saline (0.6 ml/kg of 0.9% NaCl) orally; groups 2, 3 and 4 received L-NAME (40 mg/kg) orally to induce hypertension for a period of three weeks. Treatments were continued for another 3 weeks with groups 3 and 4 being further treated orally with 100 and 200 mg/kg of TPALE respectively. Blood pressure, body and reproductive organs weight, histology of reproductive organs, fertility success, plasma testosterone and luteinizing hormone (LH) and seminal analysis were determined.¹⁶

Table – 03: Pharmacological Activities of the Plant and Corresponding Experimental Methods

S. No.	Pharmacological Activity / Disease	Animal Used	Plant Part Used	Dose Concentration	Method Used / Experimental Model
1	Anti-Diabetic Activity	Rats (normal & alloxan-induced diabetic)	Whole plant	Not specified	Whole plant extracted with 50% methanol; tested for acute toxicity and anti-hyperglycemic activity; body weight and oral glucose tolerance measured.
2	Anti-Arthritic Activity	Female Sprague Dawley (SD) rats	Whole plant	250 and 500 mg/kg (extract); 10 mg/kg indomethacin (standard)	Freund's Complete Adjuvant (FCA)-induced arthritis model; 95% ethanolic extract via Soxhlet extraction; liver enzyme levels and radiological analysis performed.
3	Anti-Inflammatory Activity	<i>In vitro</i> (no animal)	Not specified (gel formulation)	Not specified	BSA and Egg Albumin denaturation assays; DPPH and H ₂ O ₂ radical scavenging assays.



4	Anti-Bacterial Activity	<i>In vitro</i> (bacterial species)	Leaves	Not specified	Agar well diffusion method; petroleum ether, chloroform, and ethanolic extracts tested against Gram-positive and Gram-negative bacteria.
5	Wound Healing Activity	Albino Rats	Whole plant	Not specified	Dead space wound model; whole plant extract (WPE), aqueous extract (AE), butanol fraction (BF), and petroleum ether fraction (PEF) tested; lysyl oxidase activity, tensile strength, and biochemical parameters evaluated.
6	Anti-Tubercular Activity	<i>In vitro</i> (<i>Mycobacterium tuberculosis</i> H37Rv)	Whole plant	MIC = 600 µg/mL	Disk diffusion and Microplate Alamar Blue Assay (MABA); FTIR, GC–MS, and molecular docking performed to identify active compounds.
7	Anti-Cancer Activity	<i>In silico</i> (human lung cancer target)	Luteolin (phytochemical from whole plant)	Computational study	Molecular docking and molecular dynamics simulations; ADMET and drug-likeness prediction of luteolin.
8	Hepatoprotective Activity	Rats	Aerial parts	300 mg/kg (ethanolic extract fraction)	D-Galactosamine/Lipopolysaccharide (d-GalN/LPS)-induced hepatitis model; biochemical and histopathological liver analyses.
9	Anti-Oxidant Activity	<i>In vitro</i>	Not specified	Not specified	DPPH and other radical scavenging assays; assessed antioxidant capacity against ROS, OH•, O ₂ • ⁻ , H ₂ O ₂ , etc.
10	Anti-Hypertensive Activity	Male Rats	Leaves (aqueous extract)	100 and 200 mg/kg	L-NAME-induced hypertension model; blood pressure, reproductive organ histology, fertility success, plasma testosterone, LH, and seminal parameters evaluated.

Table -4: Pharmaceutical Formulation of *Tridax procumbens*

Dosage Form	Type of Extract	Notes
Topical Gel (2–8%)	Methanolic / Ethanolic extract	Strong wound-healing effect
Herbal Ointment	Hydroalcoholic extract	Antibacterial & anti-inflammatory
Hydrogel Films	Flavonoid-rich extract	Used in wound dressings
Capsules/Tablets	Standardized powder/extract	For cardio-protective & antidiabetic uses
Syrup/Tonic	Aqueous or hydroalcoholic	For lipid management & immune support
Nano gels / Nanoparticles	Silver nanoparticles (Tridax mediated)	Enhanced antimicrobial action

RESULT AND DISCUSSION

The review on *Tridax procumbens* Linn., commonly known as coat buttons, highlights its diverse pharmacological and phytochemical properties that justify its traditional medicinal uses. Phytochemical screening revealed the presence of flavonoids, alkaloids, tannins, saponins, carotenoids, phenols, sterols, and organic acids, which contribute to its wide therapeutic spectrum. Experimental studies demonstrated significant anti-diabetic, antiarthritic,

anti-inflammatory, antibacterial, and wound-healing activities, with methanolic and ethanolic extracts showing potent biological responses in both in vivo and in vitro models. The plant also exhibited anti-tubercular and anticancer potential, supported by molecular docking and GC–MS analyses that identified active compounds such as luteolin and oleanolic acid. Its hepatoprotective effect was confirmed through normalization of liver enzymes and tissue architecture in d-GalN/LPS-induced hepatitis in rats. Moreover, antioxidant assays



revealed strong radical-scavenging properties attributed to high phenolic and flavonoid content, while cardiovascular studies confirmed vasorelaxant and antihypertensive actions mediated by nitric oxide and cyclic nucleotide pathways. Overall, the results support that *Tridax procumbens* possesses multi-dimensional pharmacological potential, low toxicity, and accessibility, making it a valuable candidate for developing affordable plant-based therapeutics and new drug leads.

Table-05: Mineral Element Composition of *Tridax procumbens* leaves

Minerals	Dry Weight	Wet Weight
Calcium	20.96	2.09
Magnesium	3.56	0.35
Potassium	31.92	3.18
Sodium	50.44	5.02
Selenium	0.20	0.02

Table – 6: Qualitative profile of Phytochemicals found in *Tridax procumbens* leaves

Phytochemical	Status
Alkaloids	+
Carotenoids	++
Flavonoids	+
C Catechin	-
C Flavones	+
Saponins	+
Tannis	++

CONCLUSION

Tridax procumbens Linn. Widely known as coat buttons, emerges from this review as a potent medicinal herb with diverse pharmacological activities, including antidiabetic, antioxidant, anti-inflammatory, antibacterial, wound-healing, hepatoprotective, anticancer, and antihypertensive properties. It is rich phytochemical composition—comprising flavonoids, alkaloids, tannins, saponins, carotenoids, and sterols—contributes significantly to its therapeutic potential. Experimental and computational studies validate many of its traditional uses, highlighting its low toxicity and broad

biological efficacy. The plant's accessibility, affordability, and pharmacological versatility make it a promising candidate for developing safe, plant-based therapeutics. However, further detailed clinical and mechanistic studies are essential to standardize its bioactive components and fully establish its role in modern drug development.

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