INFORMATICS JOURNALS

Short Review

Journal of Natural Remedies
DOI: 10.18311/jnr/2026/55609

eISSN: 2320-3358 | Vol 26(9), 2026 | pp. 2405-2417

# Phytochemical and Therapeutic Potential of *Tridax procumbens*: A Review

**Sakthiganapathi Meenachisundaram[1*], Swedha Jaganathan[1], Gayathiri Kichenamourty[2], Ahalya Sivaguru Paramesh[3] and Siventhi Subrayan[4]**

[1]School of Pharmacy, Sri Balaji Vidyapeeth (Deemed to be University), Puducherry – 607403, Tamil Nadu, India; sakthiganapathim@sbvu.ac.in

[2]Department of Pharmacology, SRM College of Pharmacy, SRM Institute of Science and Technology, Chennai – 603203, Tamil Nadu, India

[3]Faculty of Pharmacy, Sree Balaji Medical College and Hospital Campus, Bharath Institute of Higher Education and Research, Chennai – 600044, Tamil Nadu, India

[4]Surya School of Pharmacy, Vikravandi – 605652, Tamil Nadu, India

## Abstract

*Tridax procumbens* is a low-growing perennial herb widely occurring in tropical and subtropical climates and extensively used in folk medicine. Though commonly viewed as an invasive weed, there are many valid uses for this plant based on the increasing body of experimental data. The objective of this article is to provide a detailed review of the botanical features, geographic distribution, chemical structure and pharmacology of *T. procumbens*. Chemical studies have demonstrated a number of different classes of bioactive compounds, including terpenoids, sterols, glycosides, phenolic acids, flavonoids and fatty acids, which, together with their respective mechanisms of action, demonstrate the therapeutic potential of this plant. Pharmacological evaluation using validated *in vitro* and *in vivo* models demonstrates the following activities of *T. procumbens*: wound healing, anti-inflammatory, antioxidant, antibacterial, hypoglycemic, hypocholesterolemic, immunomodulatory, uricosuria, hepatic protection, arthritis prevention and cardiovascular protection. The plant has also been demonstrated to inhibit several major enzymes (cyclooxygenase and xanthine oxidase) that could be beneficial in managing both inflammatory disorders and metabolic conditions. In addition, advancements in formulation technologies (such as phytosomal formulations, nano-herbal formulations, and polymer-based composite formulations) have provided enhanced bioavailability, enhanced thermostability and enhanced therapeutic efficacy of *T. procumbens* extracts, especially in topical and antimicrobial applications. The global distribution, adaptability, and multifunctional pharmacologic activity of *T. procumbens* provide evidence of the plant's potential as a valuable source of novel drugs and/or drug leads. Further studies to elucidate mechanisms of action, standardise extraction methods, assess toxicity and evaluate effectiveness through clinical trials will help ensure the successful transition of *T. procumbens* from an experimental compound to a clinically proven therapeutic agent.

**Major Findings:** *Tridax procumbens* demonstrates anti-inflammatory, antioxidant, antimicrobial, antidiabetic, antihyperlipidemic, immunomodulatory, hepatoprotective and cardiovascular activities in experimental models.

**Keywords:** Anti-inflammatory Activity, Medicinal Plant, Phytochemicals, *Tridax procumbens,* Wound Healing Activity

(Article Chronicle: Article Received on: 30.03.2026; Revised on: 24.06.2026; Accepted on: 19.07.2026)

## 1. Introduction

The widespread perennial herb "*Tridax procumbens*" (*Asteraceae*) grows rapidly and is found on most continents across tropical and subtropical regions of the globe. While many consider it to be a nuisance along roadsides, this plant has an ability to grow well under various environmental stresses, which allows it

*Author for correspondence

to grow well in poor soils, disturbed lands, and even in urban areas. The plant has stems that creep, and leaves are ovate and serrated; the flower is similar to a daisy with yellow disc florets and white ray florets. Its strong and resilient nature has allowed for the rapid spread of this plant and provides continued access to it as a medicinal resource[1,2]. *T. procumbens* has been used in folklore medicinal systems for generations, particularly in India and other tropical regions, as a remedy for many ailments including wounds, infections, skin diseases, liver problems, diabetes and inflammation[3]. This use in folklore medicine systems can be attributed to the high concentration of phytochemicals within the plant (e.g., flavonoids, alkaloids, sterols, fatty acids, saponins, tannins, carotenoids, phenolics) that are found throughout the plant's leaves, stem and aerial parts[4]. *T. procumbens* is considered to produce secondary metabolites that contribute to the wide range of biological activity attributed to this plant through synergy[5,6]. Traditional claims regarding the use of *T. procumbens* have been substantiated by significant amounts of experimental data derived from *in vitro* and *in vivo* pharmacological research studies. Such studies have demonstrated that the plant exhibits anti-inflammatory, antibacterial, antidiabetic, hepatoprotective, anti-arthritis, antioxidant, antiparasitic, anticoagulant, and wound-healing activities. Additionally, mechanistic studies have identified *T. procumbens* as modulating oxidative stress pathways, inhibiting carbohydrate-metabolising enzymes and suppressing inflammatory mediators (such as COX-2 and TNF-α), which suggests the plant exhibits a multi-target mechanism of action[7–9]. Although conventional extract-based studies have traditionally represented the majority of the research concerning *T. procumbens*, current research has progressed toward exploring the application of *T. procumbens* in modern pharmaceutical contexts. The introduction of novel delivery systems, including phytosome formulations, polymer-based composite systems and nano-herbal formulations, has been examined to improve the bioavailability of the active ingredients, to enhance the effectiveness of the antimicrobial activity, and to expedite the process of tissue repair. Therefore, the feasibility of using *T. procumbens* within modern drug development paradigms is indicated[10,11]. Although there is considerable pharmacological evidence, the scope of research into the safety profile of *T. procumbens* and the determination of optimal dosages and potential toxicities remain underdeveloped; therefore, the necessity for a complete evaluation is established. This review article provides an integrated discussion of *T. procumbens*; this includes the botanical characteristics of *T. procumbens*, the global geographic locations where the plant can be found, the chemical constituents of the plant, and the medicinal properties exhibited by the plant based on experimental evidence[12]. Additionally, this review seeks to integrate traditional knowledge related to *T. procumbens* and modern scientific evidence to provide a critical assessment of the therapeutic value, safety considerations, and prospects of *T. procumbens* as a potential source of bioactive compounds for the production of phytopharmaceuticals and biomedical products[13,14].

## 2. Botanical Description

*Tridax procumbens* Linn. is an annual creeping perennial herb in the *Compositae* (*Asteraceae*) family that grows in most tropical and subtropical areas of the world. The creeping growth of the plant is due to its extremely branched stems that grow along the surface of the soil and produce roots at their nodes, allowing for quick vegetative spread. Young stems are green and pubescent; mature stems are slightly woody. Leaves are simple, petiolate, oppositely arranged, and are either ovate or lanceolate in form and approximately 3-7 cm in length[15,16]. They possess irregularly serrated margins, a rough surface texture, and are covered with fine hairs. The inflorescence consists of solitary, long-stalked capitula borne on elongated peduncles. Each flower head contains white or pale cream ray florets at the periphery and numerous yellow tubular disc florets at the centre, giving a characteristic daisy-like appearance[17]. Flowering occurs throughout much of the year under favourable conditions. The fruit is a tiny, hard achene with a feathery pappus of stiff hairs, which help in the good wind dispersal of seeds[18].

The plant is highly adaptable and grows abundantly in open sunny locations such as roadsides, lawns, agricultural fields, wastelands, and grasslands. Its ability to tolerate poor soil conditions and environmental stress contributes to its classification as a common weed in many regions. Despite this, it is largely

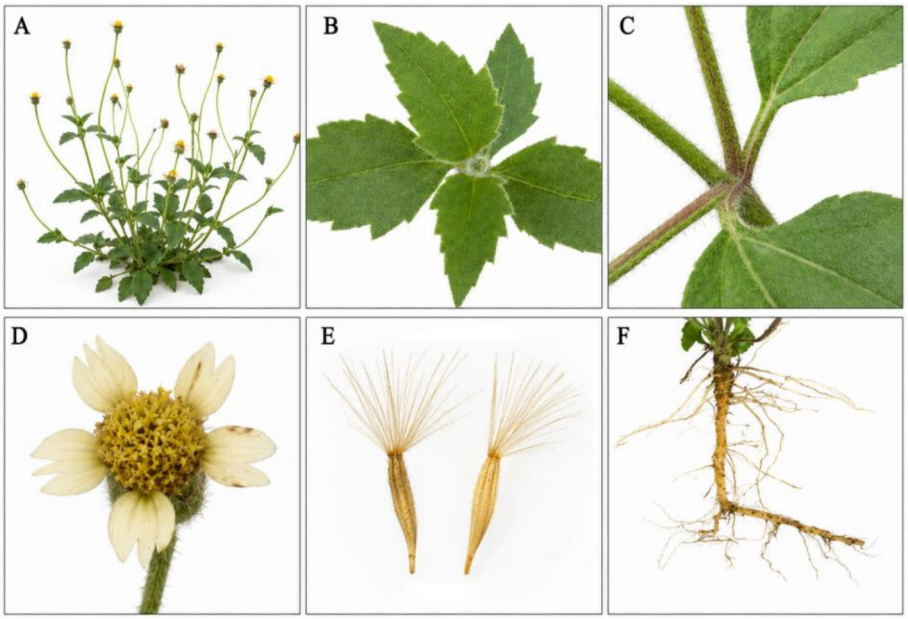



**Figure 1.** Morphological features of *Tridax procumbens,* **A.** – Whole plant; **B.** – Leaves; **C.** –Stem; **D.** – Flower; **E.** – Seed; **F.** – Root.

**Table 1.** Taxonomic classification of *Tridax procumbens*

| Parameter | Description |
|---|---|
| Scientific name | *Tridax procumbens* Linn. |
| Common name | Tridax daisy, Coat buttons |
| Family | *Asteraceae* |
| Kingdom | *Plantae* |
| Division | *Angiosperms* |
| Class | *Eudicots* |
| Order | *Asterales* |
| Genus | *Tridax* |
| Species | *T. procumbens* |

known in traditional medicine systems because of its therapeutic value[19–21]. The Morphological features of *T. procumbens* are shown in Figure 1, and the Taxonomical classification of *T. procumbens* is presented in Table 1.

## 2.1 Geographical Distribution and Habitat

*Tridax procumbens* Linn. is widely distributed across tropical and subtropical regions of the world and is considered to have originated in tropical Central America, from where it has spread extensively to South Asia, Southeast Asia, Africa, and Northern Australia through natural dispersal and human-mediated activities[2,21]. In South Asia, the plant is found throughout India, Nepal, Bangladesh, and Sri Lanka, while in Southeast Asia it is well established in Thailand, Malaysia, and Indonesia, where it commonly grows in roadsides, agricultural lands, grasslands, and wastelands[1,4,22]. *T. procumbens* shows strong tolerance to high temperatures, low rainfall, poor soil fertility, and disturbed habitats, and occurs from sea level to moderate elevations, reflecting its wide ecological adaptability[23]. The species has also successfully colonised African regions and Northern Australia, where its drought tolerance, rapid growth, and efficient seed dispersal have facilitated its naturalisation[21,24]. Due to its extensive global distribution and ongoing availability, *T. procumbens* has developed as a significant medicinal and phytopharmaceutical resource; however, it is spreading aggressively into native ecosystems; thus, there is a need to monitor it ecologically so that it does not become an invasive species (Figure 2)[14].

## 3. Materials and Methods

This literature review was conducted by conducting a systematic search of peer-reviewed journal articles regarding *T. procumbens*, and then analysing these publications through academic databases such as Google Scholar; PubMed; Science Direct; Open Access Journal Platforms. Keywords used for the search

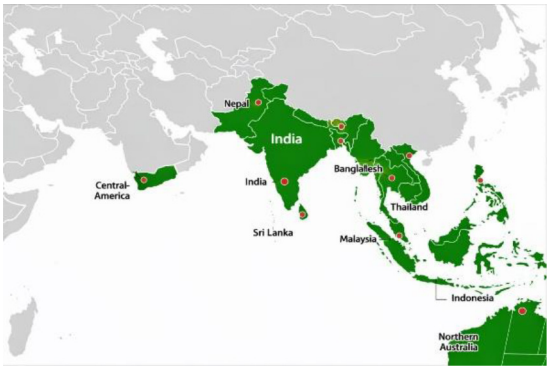



**Figure 2.** Geographical distribution of *Tridax procumbens* across tropical and subtropical regions.

included "*Tridax procumbens*", "phytochemistry", "pharmacological activity", "wound healing", "anti-inflammatory", "antimicrobial", "antidiabetic", and "hepatoprotective". Only experimental studies that were peer-reviewed and reported phytochemical constituents, extraction methods, pharmacological properties, toxicity studies and formulation methods of *T. procumbens* were included. Studies were excluded if they did not relate directly to the plant or were of poor experimental or scientific design to ensure quality and relevance. The selected articles were systematically screened, and relevant data on plant parts used, extraction procedures, identified compounds, biological activities, and safety profiles were extracted and organised under thematic headings for comparative analysis and narrative synthesis.

## 3.1 Phytochemical Composition

Phytochemical research published in the scientific literature reveals that *T. procumbens* Linn. includes many bioactive secondary metabolites which are associated with its medicinal properties (Table 2). Preliminary phytochemical screening of the leaves has been reported to reveal the presence of flavonoids, alkaloids, phenolic compounds, tannins, and saponins. These classes of compounds are commonly associated with antioxidant, anti-inflammatory and antimicrobial activities[2,25].

## 3.2 Pharmacological Activities

Several studies have demonstrated that *T. procumbens* has multiple pharmacological effects when tested with various model and study designs. The major biological

**Table 2.** Major phytochemical constituents identified in *Tridax procumbens*[26]

| Sr. No. | Class of Compound | Reported Phytoconstituents |
|---|---|---|
| 1 | Flavonoids[27] | Luteolin, Quercetin, Centauredin, Centaurein, Rutin |
| 2 | Steroids / Sterols[28,29] | β-Sitosterol, Stigmasterol, Campesterol |
| 3 | Sterol Glycosides[30,31] | β-Sitosterol-3-O-β-D-xylopyranoside |
| 4 | Terpenoids[32] | α-Amyrin, β-Amyrin, Lupeol |
| 5 | Fatty Acids[33] | n-Hexadecanoic acid, Tetradecanoic acid, Octadecanoic acid |
| 6 | Terpenes[30] | Caryophyllene, trans-α-Bergamotene |
| 7 | Phenolic acids[29] | Gallic acid, Caffeic acid |

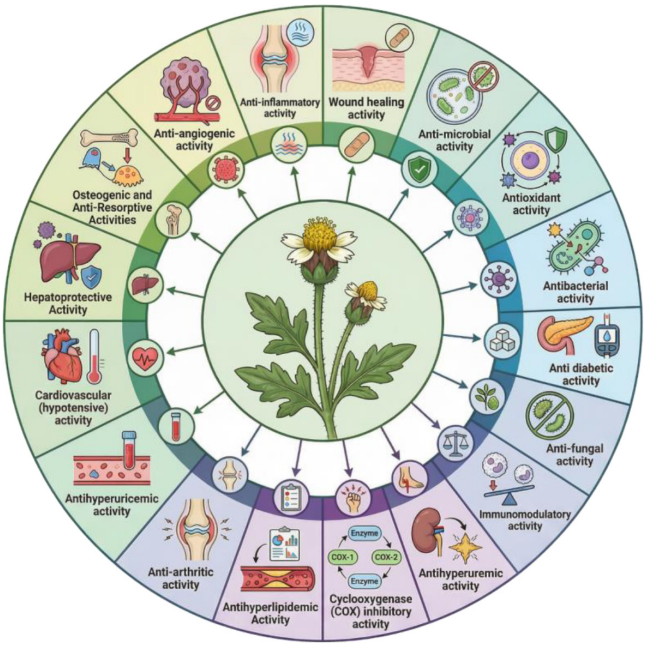



**Figure 3.** Reported pharmacological properties of *Tridax procumbens.*

effects documented for this plant are summarised in the following subsections (Figure 3)[34].

### 3.2.1 Anti-inflammatory Activity

Standardised aerial parts extracts from the plant, *T. procumbens*, that were prepared by using ethyl acetate, methanol and hydro-ethanol were tested for their anti-inflammatory potential using the carrageenan-induced paw oedema model. From the extracts, the ethyl acetate

extract was found to have maximum inhibition of oedema within an equivalent range of ibuprofen. The anti-inflammatory effect was attributed to inhibition of cyclooxygenases Cox-1 and Cox-2 enzymes, causing a decrease in prostaglandin synthesis, with centaureidin and bergenin as the major active constituents[1].

Further testing of whole-plant ethanolic and standardised ethanolic extracts from *T. procumbens* was performed in carrageenan-induced paw oedema and cotton pellet granuloma models to assess both acute and chronic inflammatory responses. The extracts produced a reduction in paw oedema and granuloma formation and normalised biochemical parameters (ALT, AST, ALP) and lipid peroxidation; overall, the total anti-inflammatory effect was similar to diclofenac and indicates modulation of the inflammation and oxidative stress pathways[35].

Ethanolic leaf extract from *T. procumbens* exhibited dose-dependent inhibition of carrageenan-induced paw swelling in Swiss albino mice; histopathology of the area of inflammation showed favourable changes. Using RT-PCR and qPCR for molecular evaluation, there were significant decreases in the expression of the pro-inflammatory mediators TNF-alpha and COX-2 COX-2 Positive expression of COX-1/2 is a marker in the synthesis of prostaglandins and thromboxanes, which serve as mediators of inflammatory processes. As a result, the anti-inflammatory activity of *Tridax* leaf extract was similar to indomethacin, thus demonstrating that *T. procumbens* inhibited the inflammatory response both at a cellular and molecular level[9].

### 3.2.2 Wound Healing Activity

*Tridax procumbens* wound healing activity has been documented using both *in vivo* and *in vitro* experimental models, demonstrating that it is involved in tissue regeneration and repair. The topical application of leaf juice ointment to excised wounds on the dorsal skin of Swiss albino mice at optimal concentration (1mg/g) accelerated wound closure through re-epithelialization, fibroblast proliferation, neovascularisation, collagen deposition and produced effects comparable to standard VEGF ointments. Conversely, a higher concentration (4 mg/g) induced oedema and inflammation as well as reduced collagen synthesis, clearly demonstrating a concentration dependent response[36].

Complementary, *in vitro* scratch assay studies that used L929 fibroblast cells further confirmed these results, with the phytosomal gel formulation of *T. procumbens* exhibiting superior wound closure (48 h) of 54.34%, relative to the crude ethanolic extract (41.57%). This was due to better efficacy, as a result of increased fibroblast migration and proliferation through phospholipid complexation, in the presence of which better penetration, sustained release and longer retention of the bioactive constituents at the wound area occur. These data, in combination, support the claim that *T. procumbens* enhances the efficacy of wound healing by maximising the topical delivery of the agent and the regulation of major cellular processes of tissue remodelling[9,37].

### 3.2.3 Antimicrobial Activity

The efficacy of *T. procumbens* as an antimicrobial agent was increased with multiple formulation approaches that exhibited higher activity against bacteria and fungi than unmodified agents. A phospholipid complex (phytosomal) gel prepared from the ethanolic extract exhibited superior antibacterial activity against *Escherichia coli* in agar well diffusion studies, producing a larger zone of inhibition (32 mm) compared to the crude extract (28 mm) and showing activity comparable to amikacin (30 mm). This improvement was attributed to enhanced penetration and bioavailability of phytoconstituents achieved through phospholipid complexation[23,25].

Further enhancement of antimicrobial activity was observed with a *T. procumbens* chitosan composite, which exhibited significantly higher efficacy against wound-associated bacteria (*E. coli, Staphylococcus aureus, Pseudomonas aeruginosa,* and *Klebsiella pneumoniae*) and fungi (*Aspergillus niger, Microsporum canis,* and *Cephalosporium acremonium*) than either component alone. The composite showed low MIC values (12.5 mg/mL for bacteria and 6.25–12.5 mg/mL for fungi), attributed to the synergistic interaction between plant phytochemicals and the membrane-disrupting properties of chitosan[38,39].

The biosurfactant-based nano herbal ointment containing *T. procumbens* extract, gelatin-stabilised silver nanoparticles, and rhamnolipid biosurfactant has a high level of antibacterial activity against *S. aureus* and *E. coli*. At 100 µg/mL, the formulation

produced marked zones of inhibition (19.5 mm and 15.5 mm, respectively) with minimal bacterial growth. The enhanced antimicrobial effect was attributed to the combined action of phytochemicals, silver nanoparticles, and biosurfactants, which facilitate membrane disruption and improved delivery of active constituents[35].

### 3.2.4 Antioxidant Activity

A lot of studies have investigated the antioxidant capacity of *T. procumbens* by means of both *in vivo* and *in vitro* experimental models. The ethanolic extract in this study was tested for its antioxidant potential by DPPH free radicals (reducing power assay) and by estimating the total phenolic content. As it was shown, the ethanolic extracts have very good free radical-scavenging properties, with the degree of inhibition being 96.7 % at the concentration of 250 µL/mL, which is much greater than those of ascorbic acid (94.8 %) and Gallic acid (92.9 %). In addition, the ethanolic extracts showed a strong reducing power (0.89), similar to that of gallic acid (0.99), which indicated a good ability of the extract to donate electrons. Additionally, the high total phenolic content (12 mg/g GAE) indicates a strong relationship between phenolic compounds and their antioxidant properties[40,41].

The ethyl acetate extract of *T. procumbens* was further investigated by the use of DPPH and ABTS to assess its antioxidant activities. The F48–50 fraction exhibited the highest degree of antioxidant activity among all fractions tested, exhibiting an $IC_{50}$ value of 0.51 mg/mL (DPPH) and 1.04 mg/mL (ABTS). The bioactive compounds contained within this fraction were identified by phytochemical analysis (GC-MS and LC-ESI-MS), revealing glycerides, fatty acids, sugar alcohols, and flavonoids including centaureidin. The data indicate that a few bioactive fractions were able to contribute to antioxidant activity through redox-active compounds[42]. The antioxidant performance of the standardised aerial parts extracts that were prepared in ethyl acetate, methanol and 70% ethanol using DPPH and ABTS methods was compared. All extracts showed good to high levels of free radical scavenging activities, and the methanolic extract appeared to have greater antioxidant activity. However, all extracts showed less activity than the standard antioxidants (Trolox and ascorbic acid); the individual phytochemicals extracted from the plant, including centaureidin, centaurein and bergenin, had weak radical scavenging effects, which confirmed that polyphenols and flavonoids contribute to the overall antioxidant capacity of the plant[43].

Further research investigated the antioxidant properties of *T. procumbens* with both *in vivo* and *in vitro* methods. The DPPH assay results from *in vitro* experiments indicated that the antioxidant activity of the chloroform fraction of the ethanolic extract was greater than the ethyl acetate fraction; this is largely due to the flavonoid and alkaloid content in the fractions. The *in vivo* antioxidant activity of *T. procumbens* leaf extracts was evaluated in animal models subjected to oxidative stress, and it demonstrated a significant decrease in the level of lipid peroxides and an increase in the levels of endogenous antioxidant enzymes such as superoxide dismutase, catalase, glutathione peroxidase, and reduced glutathione[44].

Additionally, antioxidant activity of *T. procumbens* leaf extracts prepared using different organic solvents was evaluated using DPPH radical scavenging and reducing power assays. Ethanolic and methanolic leaf extracts showed concentration-dependent antioxidant activity, with the ethanolic extract exhibiting up to 82.5% DPPH scavenging at 200 mg/mL, while the methanolic extract exhibited greater reducing power. The observed antioxidant activity was closely linked to the presence of flavonoids, tannins, phenolics, and polyphenols, confirming the leaves as a potent natural source of antioxidants[45,46].

### 3.2.5 Antibacterial Activity

The antibacterial effects of *T. procumbens* leaf extracts were determined by testing them for their ability to inhibit bacterial growth by utilising a standard agar well diffusion assay against both Gram-negative (*E. coli*, *P. aeruginosa*) bacteria and Gram-positive (*B. subtilis*, *B. faecalis*). Concentrations of chloroform, petroleum ether, and ethanolic extracts ranged from 200 – 800 µg/mL, among which the chloroform extract exhibited the strongest antibacterial activity against both bacterial groups. At 800 µg/mL, its activity against *B. faecalis* and *E. coli* was comparable to ampicillin, attributed to bioactive constituents such as alkaloids, tannins, steroids, and purines[47].

In another study, antibacterial activity of *T. procumbens* solvent extracts and fractions was assessed

using disc diffusion and MIC methods against *E. coli*, *S. aureus, P. mirabilis* and *B. subtilis.* Antibacterial efficacy ranged from 10 – 25 mg/mL, with the ethyl acetate extracts showing the most potent antibacterial effect, whereas hexane and chloroform extracts demonstrated very low levels of antibacterial effectiveness. Further separation and characterisation of the F4–5 fraction resulted in the identification of the major antibacterial compound (stigmasterol). *T. procumbens* leaves were extracted with methanol and ethyl acetate, then tested for antibacterial properties versus *S. aureus, K. pneumoniae, S. typhi*, *E. coli* and *B. cereus* by using two methods (disc diffusion and agar well diffusion). The ethyl acetate fraction produced larger and stronger antibacterial inhibitions compared to the methanolic fraction; the inhibitory zones produced by the ethyl acetate fraction were similar to those of streptomycin, especially when testing against *S. aureus, S. typhi* and *B. cereus*. The enhanced activity was attributed to enriched bioactive phytoconstituents in the ethyl acetate fraction[48,49].

The aqueous extraction of *T. procumbens* leaf was ineffective as an antimicrobial agent, while the ethanol extraction was effective against drug-resistant strains of *P. aeruginosa*. At doses of 2.5 mg and 5 mg, the extract exhibited antibacterial activity comparable to Augmentin, cefotaxime, ciprofloxacin, and imipenem, which was attributed to as having flavonoid and tannins[24].

Additional *in vitro* studies using disc diffusion assays demonstrated that methanolic, ethanolic, and ethyl acetate extracts of *T. procumbens* leaves exhibited appreciable antibacterial activity against *E. coli, B. subtilis, S. aureus*, and *E. aerogenes*, whereas aqueous extracts showed minimal effects. The antibacterial effect was due to the presence of flavonoids, alkaloids, tannins and polyphenols. Therefore, it has been shown that the choice of extraction solvent may have a significant effect on the quantity of active compounds in the extraction of leaves of *T. procumbens*[46].

### 3.2.6 Antidiabetic Activity

*Tridax procumbens* has the ability to reduce blood sugar levels, and there exists some support from *in vitro* and *in vivo* studies that demonstrate its potential ability to do so. In an *in vivo* study using alloxan-induced diabetic Wistar rats, aqueous and alcoholic extracts of leaves, 200 mg/kg of body weight of the person, were administered orally and showed that the aqueous and alcoholic extracts significantly lowered blood sugar levels for 7 days, but the petroleum ether extract was not active at this dose. This hypoglycaemic effect was attributed to some phytoconstituents which are polar and may have a protective or restorative effect on the functional integrity of pancreatic beta cells damaged by alloxan[50].

Complementary *in vitro* α-amylase inhibition studies further supported the antidiabetic activity of *T. procumbens*. Among chloroform, petroleum ether and methanolic extracts, the methanolic extract exhibited the strongest, concentration-dependent α-amylase inhibition, with superior activity compared to the other extracts and comparable to standard inhibitors. This effect was mainly attributed to flavonoids, particularly quercetin, which are known to regulate post-prandial hyperglycaemia[14,51].

Oral treatment of ethanolic whole plant extract at 250 and 500 mg/kg in streptozotocin-nicotinamide-induced diabetic rats resulted in a significant decrease in fasting blood glucose levels, and a dose-dependent response was shown after 21 days of treatment. The higher dose demonstrated efficacy comparable to glibenclamide and prevented diabetes-associated body-weight loss. The observed antidiabetic effect was linked to flavonoids, phenolic compounds, and saponins, which enhance glucose utilisation and preserve pancreatic β-cell function[22].

### 3.2.7 Antifungal Activity

The antifungal properties of *T. procumbens* have been shown against clinically relevant human skin pathogens by way of methanolic extract and its dichloromethane (DCM) fraction. Methanolic extract produced zones of inhibition of 17-25 mm against dermatophytes and yeasts, whereas the DCM fraction was more potent (maximum inhibition zone of 32 mm), particularly against *Candida albicans*. The lower minimum inhibitory concentration (MIC) values for the DCM fraction (0.4-3.2 mg/mL) when compared to methanolic extract (1.6-12.8 mg/mL) indicate greater antifungal potency. Fatty acid derivatives and sterols were identified through GC-MS as major constituents contributing to the antifungal effect of *T. procumbens*; this is supported by the traditional usage of *T. procumbens* for the treatment of fungal skin diseases[21].

### 3.2.8 Immunomodulatory Activity

The immunomodulatory potential of *T. procumbens* was demonstrated using the ethanol-insoluble fraction of its aqueous extract in Swiss albino mice. Intraperitoneal administration (0.25 and 0.5 g/kg) significantly enhanced innate and adaptive immune responses, as evidenced by increased phagocytic index, total leukocyte count, spleen weight, and spleen leukocyte population, indicating stimulation of the reticuloendothelial system. The extract also elevated haemagglutination antibody titers, antibody-secreting cells, IgG response, and delayed-type hypersensitivity, while reducing systemic anaphylaxis. Collectively, these findings confirm the potent immunostimulatory activity of *T. procumbens* through activation of both cell-mediated immunity and humoral[20,52].

### 3.2.9 Antihyperuricemic Activity

The antihyperuricemic potential of *T. procumbens* was evaluated through *in vitro* xanthine oxidase (XO) inhibition assays, targeting uric acid biosynthesis. The ethyl acetate extract showed considerable inhibition of Xanthine Oxidase (XO), and subsequent separation identified the F45–47 fraction as the most active fraction, having an $IC_{50}$ of 133.17 µg/mL. Although significantly less potent than allopurinol, this level of activity is considered substantial in comparison to other plant-derived extracts. Phytochemical analysis demonstrated that the ethyl acetate extract contained fatty acids, glycerides, flavonoids, and centaureidin; these compounds are primarily responsible for the Xanthine Oxidase (XO) inhibitory properties of the extract. These findings suggest that *T. procumbens* exerts promising antihyperuricemic activity through enzyme-based modulation of uric acid synthesis[21,24].

### 3.2.10 Cyclooxygenase (COX) Inhibitory Activity

Cyclooxygenase (COX) inhibitory activity of standardised aerial part extracts of *T. procumbens* was analysed using both COX-1 and COX-2 enzyme inhibitory assays *in vitro*. The ethanolic, methanol, ethyl acetate, and 70% ethanol extracts were tested, of which the ethanolic and methanol extracts showed the greatest degree of cyclooxygenase isoform inhibition at a concentration of 50 ug/ml. Inhibitory activities on cyclooxygenase (COX)-2 of all three extracts were similar to the standardised *Curcuma longa* extract, and moderate COX-1 inhibitory activity was also seen. Fractionation of the ethanolic methanol extract by bioassay-guided isolation of centaureidin, centaurein and bergenin led to bergenin and centaureidin showing high degrees of COX-1 and -2 inhibition. These results suggest that some or all of the anti-inflammatory activity which has been associated with *T. procumbens* can be directly attributed to flavonoid and phenolic constituents which inhibit cyclooxygenase (COX) enzymes[43].

### 3.2.11 Antihyperlipidemic Activity

In one study, the antihyperlipidemic potential of an ethanolic extract of the whole plant of *T. procumbens* was studied in streptozotocin-nicotinamide-induced diabetic Wistar rats. The extract administered orally (doses of 250 and 500 mg/kg) for a period of 21 days showed significant correction of the diabetes induced lipid disorders showed increased total cholesterol, increased triglycerides and increased LDL-cholesterol levels, while returning decreased levels of HDL-cholesterol to normal. The lipid-lowering activity was dose-dependent and comparable to that generated by a standard lipid-lowering drug (Glibenclamide). In addition to this, the extract prevented the loss of weight observed in diabetics and rectified the abnormal levels of liver enzymes. The results show the possible application of *T. procumbens* in the treatment of diabetes mellitus hyperlipidemia based on bioactive components (Flavoids, Saponins, and Phenolic compounds) of *T. procumbens*, which are known to be regulators of lipid metabolism and reducers of dyslipidemia condition caused by diabetes[22].

### 3.2.12 Anti-arthritic Activity

*Tridax procumbens* was studied for its anti-inflammatory properties as an anti-arthritic drug in a rat model with Freund's Complete Adjuvant (FCA) induced arthritis in female Sprague-Dawley rats. Ethanolic extracts from whole plants were administered orally to the rats at 250 mg/kg and 500 mg/kg, and their disease progression was monitored by assessing paw volume, weight changes associated with the disease, biochemicals, blood cells and X-rays (radiographs). Paw oedema/joint inflammation and the body-weight reduction that occurs due to the disease were both reduced by treatment with the plant extract.

Treatment with the plant extract returned normalcy to all biochemical and hematologic abnormalities caused by the FCA-induced arthritis, including elevated liver enzymes and erythrocyte sedimentation rate (ESR), and improved low levels of haemoglobin and red blood cell (RBC) counts. Radiographic studies showed that fewer joints had narrowed spaces, less soft-tissue swelling and less bone damage than found in untreated animals. The efficacy of the plant extract was similar to indomethacin and likely due to bioactive components present in the plant, specifically tannins, alkaloids, flavonoids, and saponins, that could affect lysosomes and/or influence the production of inflammatory mediators[8].

### 3.2.13 Antihyperurecemic Activity

The ability of *T. procumbens* to be an antihyperuricemic agent was determined by utilising Xanthine Oxidase (XO) inhibition assays, which are designed to inhibit the primary enzymatic pathway that results in the production of uric acid. *T. procumbens* methanol whole plant extract inhibited XO with a high degree of efficacy at multiple concentrations, resulting in a significant decrease in the formation of uric acid. While the degree of XO inhibition produced by *T. procumbens* was less than that of the standard drug Allopurinol, the degree of inhibition provided by *T. procumbens* is sufficient to be considered pharmacologically relevant for a plant-based compound. The observed anti-hyperuricemia activity of *T. procumbens* can primarily be attributed to bioflavonoid-type compounds and other phenolic compounds, which are able to regulate the metabolic pathways of purines via the inhibition of enzymes. As such, these data provide evidence as to the use of *T. procumbens* as a natural remedy to help treat hyperuricemia and gout[42].

### 3.2.14 Cardiovascular (Hypotensive) Activity

A study examining the cardiovascular effects of *T. procumbens* aqueous leaf extract in anaesthetised Sprague-Dawley rats found that when administered intravenously to the rats at doses of 3, 6, and 9 mg/kg, the aqueous leaf extract caused a rapid dose-dependent drop in mean arterial blood pressure (MAP). The larger doses led to larger drops in MAP. At the doses of 6 and 9 mg/kg, there was also a significant decrease in heart rate, but the lower dose did not have any marked effect on heart rate. The hypotensive and bradycardic effects were of an immediate and transient nature. Mechanistic evaluation revealed that the pretreatment with atropine significantly reduced the blood pressure-lowering effect, and adrenergic blockade had no significant effect, indicating the participation of muscarinic cholinergic receptors. These findings give backing to the traditional usage of *T. procumbens* leaves in the handling of hypertension and to its cardiovascular action mediated chiefly through cholinergic methods[21,24,53].

### 3.2.15 Hepatoprotective Activity

The hepatoprotective potential of *T. procumbens* aerial parts was demonstrated in d-galactosamine/lipopolysaccharide–induced hepatitis in Wistar rats. Pretreatment with the chloroform-insoluble fraction of ethanolic extract at 300 mg/kg significantly reversed the hepatotoxicity caused by the toxin, such as alterations in liver marker enzymes (AST, ALT, ALP, LDH, g-GT and bilirubin) and corrected the altered serum and hepatic amounts of fat. Histopathological results also supported the hepatoprotection, noting low hepatocellular necrosis, low inflammatory infiltration and maintenance of normal liver architecture. The reason for this protective effect was suggested to be explained by the antioxidant and membrane-stabilising properties of constituents found in high amounts, among them flavonoids, in favour of the potentiality of *T. procumbens* as a natural agent against acute inflammatory liver injury[19].

### 3.2.16 Osteogenic and Anti-resorptive Activities

The osteogenic potency of flavonoids from *T. procumbens* was investigated on primary mouse calvaria osteoblasts to determine whether they influence bone development. Isolated flavonoid fractions were shown to increase osteoblast differentiation as indicated by higher alkaline phosphatase activity, increased osteocalcin secretion and greater formation of mineralised nodules. Gene expression studies revealed significant increases in the mRNA levels of key transcription factors for osteogenesis (Runx2 and Osterix) and in those of bone morphogenetic proteins (BMP-2, BMP-4 and BMP-7), which suggested involvement of BMP signalling in the action of these flavonoids. This was supported by the inhibition of markers of osteogenesis by treatment with noggin, a BMP antagonist. Overall, therefore, the study demonstrated that the flavonoids

of *T. procumbens* induce the maturation of osteoblasts and thus stimulate bone development via activation of the BMP-Runx2 signalling pathway; hence there is considerable evidence to suggest that flavonoids could be useful as anabolic substances in the management of diseases related to bone loss (e.g. osteoporosis)[52].

The anti-resorptive effect of the flavonoid from *T. procumbens* was tested in models of RANKL-induced differentiation of osteoclasts in primary osteoclastic cells. Treatment with the flavonoid fraction significantly inhibited osteoclast genesis, manifested as a significant inhibition of tartrate-resistant acid phosphatase (TRAP)-positive multinucleated cells and a significant inhibition of pit formation on mineralised surfaces. Molecular analysis showed that there was marked downregulation of osteoclast-specific genes and proteins, such as TRAP, cathepsin K, MMP-9 and MMP-13, which are important mediators in bone resorption. The inhibitory effect on differentiation and function of osteoclasts suggests an effective inhibition of RANKL-mediated signalling pathways. Collectively, these results make the flavonoids of *T. procumbens* valuable inhibitors of bone resorption and suggest that they can be useful in disease therapy as anti-resorptive agents in the prevention of exaggerated osteoclastic activity in osteoporosis and related metabolic bone disease[53].

### 3.2.17 Anti-angiogenic Activity

The anti-angiogenic potential of leaves of *T. procumbens* was assessed using a shellless chick embryo culture model system. Treatment with ethanolic extract of leaves caused a significant and dose-dependent inhibition of angiogenesis, as shown by the decreased development and branching of capillary networks around the developing embryo. Compared to control embryos, extract-treated groups showed progressive suppression of blood vessel growth with increasing extract concentration, indicating a clear angiosuppressive effect *in vivo*. The observed activity suggests interference with endothelial cell proliferation, migration, and maturation processes essential for neovascularisation. The anti-angiogenic effect was attributed to the presence of bioactive phytoconstituents, particularly flavonoids and phenolic compounds, known to modulate angiogenic signalling pathways. These findings support the potential of *T. procumbens* as a natural source of anti-angiogenic agents and highlight its relevance in the management of angiogenesis-dependent pathological conditions such as tumour growth and chronic inflammatory disorders[54].

## 4. Discussion

The compiled evidence indicates that *T. procumbens* is a pharmacologically versatile medicinal plant with multi-target biological activity supported by both traditional use and experimental validation. Across studies, consistent bioactivity has been reported in wound healing, anti-inflammatory, antimicrobial, antioxidant, and metabolic disorder models, reinforcing the therapeutic relevance of the species. Wound healing emerges as the most repeatedly validated property, with crude extracts and advanced formulations enhancing wound contraction, fibroblast proliferation, and tissue regeneration. Improved outcomes with phytosomal and nano-based topical systems highlight the importance of delivery strategies in maximising therapeutic efficacy. Anti-inflammatory activity demonstrated through oedema models and enzyme inhibition assays suggests modulation of multiple inflammatory pathways, including cyclooxygenase activity and cytokine regulation. Antioxidant and antimicrobial activities are consistently associated with phenolic and flavonoid content, while greater antimicrobial potency in organic solvent extracts underscores the influence of extraction methodology on biological outcomes. Metabolic studies further demonstrate antidiabetic, antihyperlipidemic, and antihyperuricemic effects mediated through enzyme inhibition, antioxidant protection, and metabolic regulation. Additional hepatoprotective and immunomodulatory activities indicate broader systemic benefits. Phytochemical investigations link these effects primarily to flavonoids, triterpenoids, sterols, and phenolic acids. However, reliance on crude extracts, variability in extraction methods, plant parts, and experimental designs limits direct comparison across studies. Toxicity assessments generally suggest a favourable safety margin at therapeutic doses, though concentration-dependent adverse effects emphasise the need for dose standardisation.

## 5. Conclusion

The pharmacological properties of *T. procumbens* are well documented due to its wealth of bioactive

phytoconstituents (flavonoids, sterols, terpenoids, fatty acids, phenolic acids, alkaloids, saponins and glycosides) which have a wide range of bioactivities (healing, anti-inflammatory, antimicrobial, antioxidant, antidiabetic, antihyperlipidemic, anti-arthritic, immunomodulatory, hepatoprotective, antihyperuricemic, antifungal and antibacterial) which may be related to cardiovascular effects. Experimental evidence based on *in vitro* and *in vivo* experiments does support many of its uses as outlined in the traditional medicine literature. The development of pharmaceutical formulations (phytosomal systems, nano-herbal ointments, polymer-based composites, biosurfactant-assisted delivery systems) has improved the bioavailability and therapeutic effect of *T. procumbens,* especially for use in wound care and antimicrobials. However, the full potential of this herb has not yet been fully realised due to a lack of standardised methods of extraction, optimal dosages and extensive long-term data on safety. Therefore, *T. procumbens* is a natural source of multiple target active substances. Future research should focus on mechanism-based studies, extract standardisation, detailed toxicological evaluation, and well-designed clinical trials to support its development as a safe and effective phytotherapeutic agent.

## 6. Acknowledgement

The authors sincerely thank academic mentors and scientific databases for their support in completing this review.

## 7. References

1. Kumar MS, Birla DK, Saluja MS. Evaluation of *in-vivo* anti-inflammatory activity of *Tridax procumbens* Linn extract. J Drug Discov Ther. 2025; 13(4):117–122.
2. Sawant RS, Godghate AG. Preliminary phytochemical analysis of leaves of *Tridax procumbens* Linn. Int J Sci Environ Technol. 2013; 2(3):388–394.
3. Kaushik D, Tanwar A, Davis J. Ethnopharmacological and phytochemical studies of *Tridax procumbens* Linn: A popular herb in *Ayurveda* medicine. Int J Eng Res Technol. 2020; 9(9). https://doi.org/10.17577/IJERTV9IS090426
4. Christudas S, Kulathivel TM, Agastian P. Phytochemical and antibacterial studies of leaves of *Tridax procumbens* L. Asian Pac J Trop Biomed. 2012; 2(1 SUPPL.):S159-S161. https://doi.org/10.1016/S2221-1691(12)60149-X
5. Gubbiveeranna V, Kusuma C, Bhavana S, Sumachirayu C, Ravikumar H, Nagaraju S. Potent procoagulant and platelet aggregation inducing serine protease from *Tridax procumbens* extract. Pharmacognosy Res. 2019; 11(4):363-370. https://doi.org/10.4103/pr.pr_4_19
6. Akintunde O, Oloye A, Adetomiwa A, Subuloye W, Olaiya C. Effects of ethanol extract of *Tridax procumbens* on spermiogram and reproductive hormones in Wistar rat. Sokoto J Vet Sci. 2017; 15(3):25-31. https://doi.org/10.4314/sokjvs.v15i3.4
7. Pareek H, Sharma S, Khajja BS, Jain K, Jain GC. Evaluation of hypoglycemic and anti-hyperglycemic potential of *Tridax procumbens* (Linn.). BMC Complement Altern Med. 2009; 9:48. https://doi.org/10.1186/1472-6882-9-48 PMid: 19943967 PMCid: PMC2790435.
8. Petchi R, Vijaya C, Parasuraman S. Anti-arthritic activity of ethanolic extract of *Tridax procumbens* (Linn.) in Sprague Dawley rats. Pharmacognosy Res. 2013; 5(2):113–117. https://doi.org/10.4103/0974-8490.110541 PMid: 23798886 PMCid: PMC3685759.
9. Berlin Grace VM, Viswanathan S, David Wilson D, Jagadish Kumar S, Sahana K, Maria Arbin EF, *et al*. Significant action of *Tridax procumbens* L. leaf extract on reducing the TNF-α and COX-2 gene expressions in induced inflammation site in Swiss albino mice. Inflammopharmacology. 2020; 28(4):929–938. https://doi.org/10.1007/s10787-019-00634-0 PMid: 31487002.
10. Devale A, Nikalaje S, Prasad NR, Varale A. Bio-inspired synthesis and bio-activity of ruthenium nanoparticles from *Tridax procumbens* (*Dagadi Pala*) leaf extract. Discover Nano. 2025; 20(1):153. https://doi.org/10.1186/s11671-025-04300-z PMid: 40915997 PMCid: PMC12414861.
11. Yaduvanshi B, Mathur R, Mathur SR, Velpandian T. Evaluation of wound healing potential of topical formulation of leaf juice of *Tridax procumbens* L. in mice. Indian J Pharm Sci. 2011; 73(3):303–306. https://doi.org/10.4103/0250-474X.93523
12. Pandey M, Pandey A, Kumar R, Pathak A, Dikshit A. A Comparative antimicrobial analysis of *Tridax procumbens* L. various extracts on waterborne bacterial pathogens. Int Curr Pharm J. 2016; 15(3):22-26. https://doi.org/10.3329/icpj.v5i3.26694
13. Martín-Quintal Z, Moo-Puc R, González-Salazar F, Chan-Bacab MJ, Torres-Tapia LW, Peraza-Sánchez SR. *In vitro* activity of *Tridax procumbens* against promastigotes of *Leishmania mexicana*. J Ethnopharmacol. 2009; 122(3):463–467. https://doi.org/10.1016/j.jep.2009.01.037 PMid: 19429313.
14. Sonawane A, Srivastava RS, Sanghavi N, Malode Y, Chavan B. Anti-diabetic activity of *Tridax procumbens*. J Sci Innov Res. 2014; 3(2):221–226. https://doi.org/10.31254/jsir.2014.3217

15. Beck S, Mathison H, Todorov T, Calderon-Juarez EA, Kopp OR. A review of medicinal uses and pharmacological activities of *Tridax procumbens* (L.). J Plant Stud. 2018; 7(1):19-35. https://doi.org/10.5539/jps.v7n1p19
16. Ghosh P, Biswas S, Biswas M, Dutta A, Sil S, Chatterjee S. Morphological, ethnobotanical and phytopharmacological attributes of *Tridax procumbens* Linn. (*Asteraceae*) a review. Int J Sci Res Biol Sci. 2019; 6(2):182–191. https://doi.org/10.26438/ijsrbs/v6i2.182191
17. Ali M, Ravinder E, Ramachandram R. A new flavonoid from the aerial parts of *Tridax procumbens*. Fitoterapia. 2001; 72(3):313-315. https://doi.org/10.1016/S0367-326X(00)00296-3 PMid: 11295316.
18. Evbuomwan SA, Omotosho OE, Akinola OO. A mini review on some known medicinal uses of *Tridax procumbens*. Trop J Nat Prod Res. 2023; 7(8):3573–3584. https://doi.org/10.26538/tjnpr/v7i8.1
19. Ravikumar V, Shivashangari KS, Devaki T. Hepatoprotective activity of *Tridax procumbens* against D-galactosamine/ lipopolysaccharide-induced hepatitis in rats. J Ethnopharmacol. 2005; 101(1–3):55–60. https://doi.org/10.1016/j.jep.2005.03.019 PMid: 15923095.
20. Tiwari U, Rastogi B, Singh P, Saraf DK, Vyas SP. Immunomodulatory effects of aqueous extract of *Tridax procumbens* in experimental animals. J Ethnopharmacol. 2004; 92(1):113–119. https://doi.org/10.1016/j.jep.2004.02.001 PMid: 15099857.
21. Policegoudra RS, Chattopadhyay P, Aradhya SM, Shivaswamy R, Singh L, Veer V. Inhibitory effect of *Tridax procumbens* against human skin pathogens. J Herb Med. 2014; 4(2):83–88. https://doi.org/10.1016/j.hermed.2014.01.004
22. Petchi R, Parasuraman S, Vijaya C. Antidiabetic and antihyperlipidemic effects of an ethanolic extract of the whole plant of *Tridax procumbens* (Linn.) in streptozotocin-induced diabetic rats. J Basic Clin Pharm. 2013; 4(4):88-92. https://doi.org/10.4103/0976-0105.121655 PMid: 24808679 PMCid: PMC3979266.
23. Mecina GF, Santos VHM, Andrade AR, Dokkedal AL, Saldanha LL, Silva LP, *et al*. Phytotoxicity of *Tridax procumbens* L. S Afr J Bot. 2016; 102:130–136. https://doi.org/10.1016/j.sajb.2015.05.032
24. Pai C, Kulkarni U, Borde M, Murali S, Mrudula P, Deshmukh Y. Antibacterial Activity of *Tridax procumbens* with special reference to nosocomial pathogens. Br J Pharm Res. 2011; 1(4):164-173. https://doi.org/10.9734/BJPR/2014/763
25. Mir SA, Dar AM. Analysis of phytochemistry and antimicrobial activity of *Tridax procumbens* Linn. Chem Sci J. 2016; 7(2). https://doi.org/10.4172/2150-3494.1000132
26. Ikewuchi Jude C, Ikewuchi Catherine C, Igboh Ngozi M. Chemical profile of *Tridax procumbens* Linn. Pak J Nutr. 2009; 8(5):548–550. https://doi.org/10.3923/pjn.2009.548.550
27. Ogunwenmo KO, Oyelana OA. Chemical constituents and pharmacological relevance of *Tridax procumbens*. Afr J Tradit Complement Altern Med. 2007; 4(3):279–283.
28. Singh P, Sharma B. GC-MS profiling of bioactive compounds in *Tridax procumbens*. Pharmacogn J. 2018; 10(1):45–51.
29. Kumar V, Yadav A. Phytochemical investigation of *Tridax procumbens* using chromatographic techniques. Int J Green Phar. 2016; 10(2):112–118.
30. Idu M, Erhabor JO, Efijuemue H. Ethnomedicinal and phytochemical studies on *Tridax procumbens*. J Med Plants Res. 2011; 5(5):943–947.
31. Taddei A, Rosas-Romero AJ. Bioactivity studies of *Tridax procumbens* extracts. Fitoterapia. 1999; 70(1):30–34.
32. Shukla S, Mehta A. Isolation and identification of bioactive compounds from *Tridax procumbens*. J Pharmacogn Phytochem. 2015; 4(3):145–50.
33. Akinloye OA, Olaniyi MO. Phytochemical screening and antimicrobial activity of *Tridax procumbens*. Afr J Biotechnol. 2010; 9(31):5097–5101.
34. Lakhera S, Rana M, Devlal K, Celik I, Yadav R. A comprehensive exploration of pharmacological properties, bioactivities and inhibitory potentiality of luteolin from *Tridax procumbens* as anticancer drug by *in-silico* approach. Struct Chem; 33(3):703–719. https://doi.org/10.1007/s11224-022-01882-7 PMid: 35106037 PMCid: PMC8795348.
35. Muthukumar B, Nandini MS, Elumalai P, Balakrishnan M, Satheeshkumar A, AlSalhi MS, *et al*. Enhancement of cell migration and wound healing by nano-herb ointment formulated with biosurfactant, silver nanoparticles and *Tridax procumbens*. Front Microbiol. 2023; 14:1225769. https://doi.org/10.3389/fmicb.2023.1225769 PMid: 37601383 PMCid: PMC10434256.
36. Ayyanar CB, Gayathri B, Rangappa SM, Siengchin S. Characterization and *in-vitro* investigation of *Tridax Procumbens* blended PVA thin membrane for wound-dressing applications. 2022. https://doi.org/10.21203/rs.3.rs-2071025/v1
37 Mohanthy SP, Rautaray KT, Jain DrR. Review of antimicrobial spectrum of *Tridax procumbens* L. (*Vishalyakarani*) and estimation of flavonoids and phenols present in its leaves in ninety six well plate methods. Int J Herb Med. 2023; 11(5):126–129. https://doi.org/10.22271/flora.2023.v11.i5b.896
38. Ossamulu IF, Usman IO, Solomon OD, Gara TY. Antimicrobial efficacy of chitosan-*Tridax procumbens* extract composite on selected wound surface microorganisms. Clinical Phytoscience. 2025; 11(1):9. https://doi.org/10.1186/s40816-025-00396-z
39. Nair S, Dixit S, Ganesh N. A comparative analysis of *in vitro* antioxidant potential of crude extracts of *Tridax procumbens* L. in different solvents and *in vitro* hypoglycemic potential

of its hydro-alcoholic extract. Pharm Biomed Res. 2016; 2(3):47–55. https://doi.org/10.18869/acadpub.pbr.2.3.47
40. Habila JD, Bello IA, Dzikwi AA, Musa H, Abubakar N. Total phenolics and antioxidant activity of *Tridax procumbens* Linn. Afr J Pharm Pharmacol. 2010; 4(3):123–126.
41. Andriana Y, Xuan TD, Quy TN, Minh TN, Van TM, Viet TD. Antihyperuricemia, antioxidant, and antibacterial activities of *Tridax procumbens* L. Foods. 2019; 8(1):21. https://doi.org/10.3390/foods8010021 PMid: 30634624 PMCid: PMC6352254.
42. Jachak SM, Gautam R, Selvam C, Madhan H, Srivastava A, Khan T. Anti-inflammatory, cyclooxygenase inhibitory and antioxidant activities of standardized extracts of *Tridax procumbens* L. Fitoterapia. 2011; 82(2):173–177. https://doi.org/10.1016/j.fitote.2010.08.016 PMid: 20804828.
43. Yaduvanshi B, Mathur R, Mathur SR, Velpandian T. Evaluation of wound healing potential of topical formulation of leaf juice of Tridax procumbens L. in mice. Indian J Pharm Sci. 2011; 73(3):303–306. doi:10.4103/0250-474X.93523.
44. Jadhav PS, Shinde PH, Mulla JAS. Formulation and evaluation of a *Tridax procumbens*-loaded phospholipid complex (phytosome) gel for wound healing and antimicrobial activities. RSC Pharm. 2026; 3(1):237-246. https://doi.org/10.1039/D5PM00243E
45. Syed A, Benit N, Alyousef AA, Alqasim A, Arshad M. *In-vitro* antibacterial, antioxidant potentials and cytotoxic activity of the leaves of *Tridax procumbens*. Saudi J Biol Sci. 2020; 27(2):757–761. https://doi.org/10.1016/j.sjbs.2019.12.031 PMid: 32210697 PMCid: PMC6997847.
46. Krishnaveni V. Evaluation of phytochemical and antibacterial activity on *Tridax procumbens* extract for wound care applications. Int J Green Pharm. 2018; 12(3):S597–S600. https://doi.org/10.22377/ijgp.v12i03.2026
47. Shaikh SS, Jamadar RJ, Shewale SS, Nazeruddin GM. Antibacterial potential of *Tridax procumbens* L. Int J Sci Res Sci Technol. 2017; 3(9):175–178.
48. Bharathi V, Varalakshmi B, Gomathi S, Shanmugapriya A, Karpagam T. Antibacterial activity of *Tridax procumbens* Linn. Int J Pharm Sci Res. 2012; 3(4):364–367.
49. Bhagwat DA, Killedar SG, Adnaik RS. Anti-diabetic activity of leaf extract of *Tridax procumbens*. Int J Green Pharm. 2008; 2(2):126–128. https://doi.org/10.4103/0973-8258.41188
50. Ngaski AA, Isah OS, Mainasara AS. Anti-hyperglycaemic effect of methanolic extract of *Tridax procumbens* in alloxan-induced diabetic Wistar rats. Sokoto J Med Lab Sci. 2024; 9(3):192–201. https://doi.org/10.4314/sokjmls.v9i3.20
51. Khairul A, Purba R, Mahati E, Kartika YD, Astuti I, Kertia N. Immunosupressant effect of the extract of *Tridax procumbens* lymphocyte cells line from patients with systemic lupus erythematous: immunoglobulin G biomarker. J Trop Pharm Chem. 2013; 2(2):68-75. https://doi.org/10.25026/jtpc.v2i2.50
52. Ara A. Effect of aqueous leaf extract of *Tridax procumbens* on blood pressure and heart rate in rats. Afr J Biomed Res. 2004; 7(1):27-29.
53. Al Mamun MA, Hosen MJ, Islam K, Khatun A, Alam MM, Al-Bari MAA. *Tridax procumbens* flavonoids promote osteoblast differentiation and bone formation. Biol Res. 2015; 48:65. https://doi.org/10.1186/s40659-015-0056-1 PMid: 26581452.
54. Al Mamun MA, Islam K, Alam MJ, Khatun A, Alam MM, Al-Bari MAA. Flavonoids isolated from *Tridax procumbens* (TPF) inhibit osteoclasts differentiation and bone resorption. Biol Res. 2015; 48(1):51. https://doi.org/10.1186/s40659-015-0043-6 PMid: 26363910 PMCid: PMC4567822.

## Author Contribution

Sakthiganapathi Meenachisundaram: Conceptualization, study design, literature search, data extraction, and manuscript preparation. Swedha Jaganathan: Literature search, data collection, analysis, and manuscript drafting. Gayathiri Kichenamourty: Literature screening, data extraction, and critical revision of the manuscript. Ahalya Sivaguru Paramesh: Literature search, data analysis, and critical revision of the manuscript. Siventhi Subrayan: Data interpretation, manuscript review, and final approval of the manuscript. All authors have read and agreed to the published version of the manuscript.