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**Review Article**

# A Review On *Tridax Procumbens Linn.*

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## ABSTRACT

Tridax procumbens Linn., commonly known as coat buttons or tridax daisy, is a wild plant that grows as a weed across India. Originally native to tropical America, it has become naturalized in tropical regions of Africa, Asia, and Australia. The plant Tridax procumbens, locally known as "Ghamara" and commonly referred to as 'coat buttons,' is utilized as "Bhringraj" in Ayurveda for promoting hair growth. Pharmacognostical studies have established its physical and leaf constants. Phytochemical analysis revealed the presence of alkaloids, carotenoids, flavonoids, fumaric acid, β-sitosterol, saponins, and tannins. The plant is rich in carotenoids, saponins, oleanolic acid, and essential ions such as sodium, potassium, and calcium. Additionally, compounds like luteolin, glucoluteolin, quercetin, and isoquercetin have been identified in its flowers. Tridax procumbens is a highly promising plant species known for producing secondary metabolites with various medicinal properties, including anti-anemic, anti-inflammatory, anti-diabetic, and anesthetic effects. It has a rich history of traditional use across different communities. The leaf juice of Tridax procumbens is valued for its antiseptic, insecticidal, and parasiticidal properties. It is used to treat conjunctivitis and prevent hemorrhage from cuts, bruises, and wounds. Additionally, it acts as an insect repellent. This review highlights the plant's prevalence in folk medicine, its diverse range of phytochemicals, and its extensive pharmacological activities.

## INTRODUCTION

Tridax procumbens Linn. (Tridax), a member of the Compositae family, is commonly known as ‘Ghamra’ and referred to as ‘coat buttons’ in English due to its flower's appearance. It has been widely utilized in Ayurvedic medicine for various ailments and is recommended as “Bhringraj,” a renowned remedy for liver disorders. Tridax procumbens, native to tropical America, has naturalized in various regions, including tropical Africa, Asia, Australia, and India. This wild herb is widely distributed across India. [1] Tridax

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procumbens has been utilized to create various products such as oils, teas, and skin poultices. This plant species exhibits diverse pharmacological properties, including immunomodulatory, antioxidant, anti-hepatotoxic, analgesic, antidiabetic, anti-inflammatory, antifungal, and antimicrobial activities. [2] [3] India has a rich heritage of traditional medicine, with its Materia medica offering valuable insights into the folklore practices and traditional uses of therapeutically important natural products. Indian traditional medicine encompasses various systems such as Ayurveda, Siddha, and Unani. The evaluation of these traditional medicines often relies on:

• Phytochemical investigation
• Pharmacological investigation
• Pharmacognostical investigation

**Taxonomical Classification**

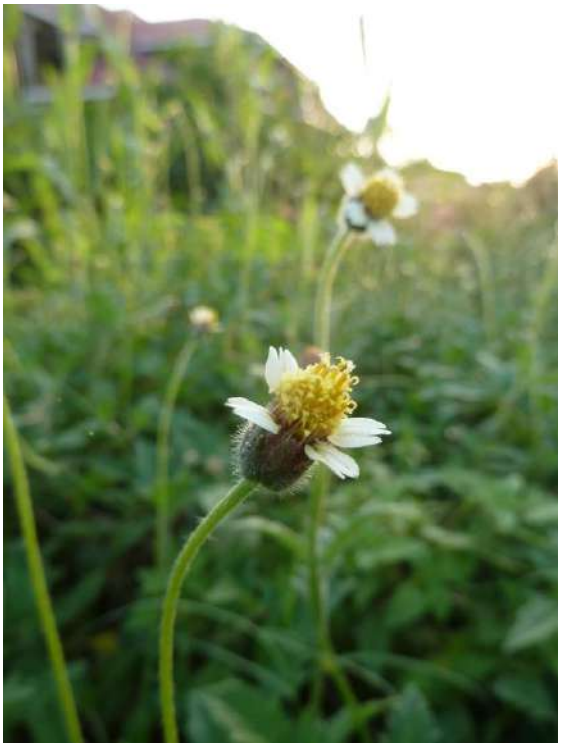
**Kingdom: Plantae (Plants)**
**Phylum: Angiosperms (Flowering Plants)**
**Class: Eudicots**
**Order: Asterales**
**Family: Asteraceae (Sunflower family)**
**Genus: Tridax**
**Species: Tridax procumbens**

**Synonym**

1. Marathi: Gaddi Chemanthi
2. Hindi: Khal muriya, Tal muriya, Ghamra
3. Sanskrit: Jayanti Veda
4. English: Coat buttons, Tridax Daisy, Wild daisy
5. Telugu: Gayapu aku, Gaddi chamanthy or Palaka aku.
6. Oriya: Dagadi pala
7. Tamil: Vettukaya thalai, Thatha

**Botanical Description**

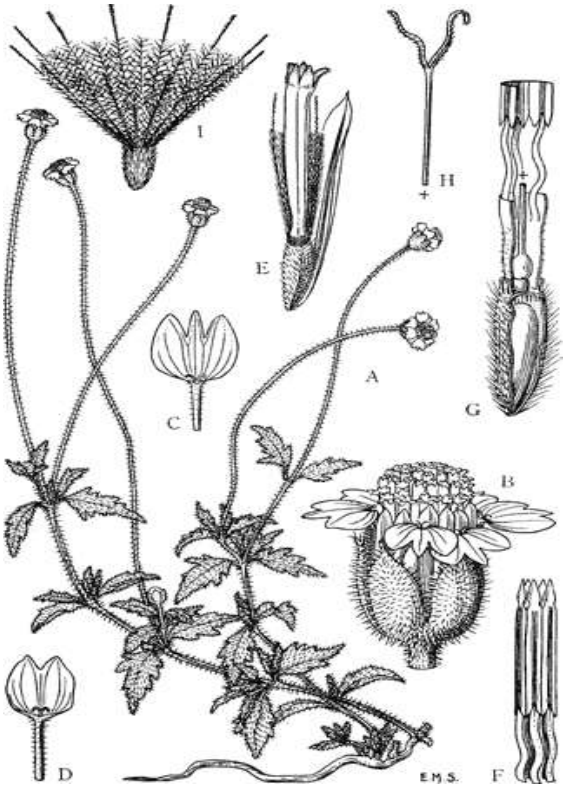
Tridax procumbens, commonly known as coat buttons, is a robust perennial herb. It grows as a low, spreading plant, often with a woody base that can root at the nodes. The plant can reach a height of up to 60 cm and has long, slender stems, about 12-24 cm in length. The leaves are small, covered in short hairs, and have an arrow-shaped appearance. The plant also produces long, solitary peduncles, which can be a foot or more in length. [4]



The leaves of Tridax procumbens are simple, opposite, and lack stipules. They are ovate-lanceolate in shape, ranging from 2 to 7 cm in length. The leaf lamina is pinnatisect, sometimes three-lobed, and has acute tips. The plant produces two types of flowers: ray-florets and disk-florets. The flowers are small and arranged in long-peduncled heads with basal placentation. The achenes (seeds) are 1.5 - 2.5 mm long and 0.5 – 1 mm in diameter, densely covered in ascending pubescence, and persistent. The bristles of the disc achenes are alternately longer and shorter, measuring 3.5 – 6 mm in length, and are part of the inflorescence capitulum. Tridax procumbens produces daisy-like flowers with a yellow center and white or yellow, three-toothed ray florets. Its fruit is a hard achene cypsela covered with stiff hairs. The plant's widespread distribution and significance as a weed can be attributed to its spreading stems and prolific seed production. [5-8]

**Microscopic study**

The leaf section of Tridax procumbens reveals a single-layered upper epidermis composed of polygonal tabular cells measuring approximately 40-70 µm by 15-30 µm. Beneath the epidermis, there is a single layer of cylindrical palisade cells, approximately 18-30 µm wide and 60-70 µm long. The spongy parenchyma, located below the palisade cells, consists of 2-4 layers of cells that are polyhedral or isodiametric in shape.




The root section of Tridax procumbens displays thin-walled tangentially elongated cells. The cortex is composed of oval to polygonal parenchymatous cells. Simple pitted vessels can be observed. The stele is encircled by a single layer of pericycle and contains xylem and phloem arranged in a circular pattern, alternating in position so that each lies on a different radius. The stem section of Tridax procumbens exhibits a cortex comprising 1-2 layers of collenchyma and 6-7 layers of parenchyma. The endodermis is not clearly defined. Powder microscopy reveals fibers measuring 175 µm in length, collenchyma cells ranging from 70-115 µm in diameter, glandular trichomes on the stem, latex cells, and root cortex cells with a diameter of 80-120 µm. Spiral vessels are observed in the leaf, and unicellular covering trichomes measuring 200 µm in length are present. [9]

**Extraction Procedure**

Different methods are employed to extract Tridax procumbens, including the use of a Soxhlet extractor. Extracts are obtained from juice of fresh leaves, dried leaves powder, and air-dried whole plant. The plant material is pulverized, and the extracts are prepared over 72 hours. The yield is found to be 6% w/v at room temperature. Standard solutions were meticulously prepared in methanol for alkaloids and tannins, and in methylene chloride for phytosterols. To ensure accuracy, the linearity of the response with respect to concentration was thoroughly verified through rigorous regression analysis. The extraction was conducted using the Tram method, while the oil extraction followed the AOAC method 999.02. Sterol analysis was performed according to AOAC method 994.10. The process included lipid extraction from homogenized samples, alkaline hydrolysis (saponification) for non-saponifiable extraction, cleanup of the extract, derivatization of sterols, and separation and quantification of sterol derivatives using gas chromatography (GC) with a capillary column. [10]

**Traditional Uses**

Indeed, traditional and complementary medicine is gaining recognition globally as an integrated approach to healthcare (WHO, 2013). The historical use of plants for medicinal purposes can be traced back to the Middle Paleolithic age, around 60,000 years ago. [11]

T. procumbens is a widespread plant found across the globe. Its uses in Central America include treating conditions such as anemia, colds, inflammation, and hepatopathies. In Guatemala, it is utilized as an antibacterial, antifungal, and

antiviral remedy. Additionally, it is employed for treating vaginitis, stomach pain, diarrhea, mucosal inflammations, and skin infections. [12] Tridax procumbens, known for its versatile medicinal applications, is widely used in Guatemala and beyond. Its leaf juice is applied to wounds to promote healing and stop bleeding. A study in Guatemala revealed its effectiveness in alleviating anemia symptoms in lactating pregnant women. The plant is employed for treating gastrointestinal and respiratory infections, high blood pressure, and diabetes. In Guatemala, it's utilized for protozoal infections like malaria, leishmaniasis, and dysentery. Aqueous extracts exhibit potent anti-plasmodial activity against chloroquine-resistant P. falciparum parasites and demonstrate efficacy against Trypanosoma brucei. Several of these traditional uses find scientific support in various studies. [13] In Nigeria, Tridax procumbens is utilized for various medicinal purposes, including treating conditions like typhoid fever, cough, fever, stomachache, backache, diarrhea, and epilepsy. [14] Additionally, farmers in Africa use the plant to treat livestock ailments, such as chronic mastitis. A study by Ayyappa Das et al. (2009) demonstrated the plant's antibacterial properties, particularly against Staphylococcus aureus. However, its effectiveness varied based on the type of extract used. In Benin, Tridax is incorporated into the feed for animals like rabbits, although these animals consume it in smaller quantities due to its low palatability compared to other fodder options. [15] In Togo, crushed leaves of Tridax procumbens are applied to wounds, and a leaf decoction is used for pain relief, malaria treatment, and gastrointestinal issues. In India, it is utilized as an insect repellent, remedy for diarrhea, and to control bleeding. Some reports also mention its use for hair loss and jaundice. Farmers in Africa incorporate Tridax in livestock feed, and it is employed alongside other plants to treat chronic mastitis in animals. The plant shows antibacterial properties against certain bacteria. Rabbit consumption of Tridax is relatively low, possibly due to its taste. [16] In Tamilnadu, India, locals utilize Tridax procumbens leaves' juice to heal wounds, and research indicates its significant value as a traditional medicinal plant. The plant is rich in essential minerals such as calcium, selenium, magnesium, potassium, and sodium. In Udaipur, India, people traditionally consume powdered T. procumbens leaves with other herbs to manage diabetes. The plant's potassium content makes it beneficial for treating cramps and holds promise for future medicinal applications. These traditional applications underscore the plant's diverse potential uses. [17][18]

**Phytochemistry**

Phytochemical studies have revealed the presence of lipid constituents, sterols, flavonoids, and polysaccharides, as well as bergenin derivatives in Tridax procumbens. Specifically, the aerial parts of the plant contain important compounds such as phytosterols like beta-sitosterol, stigmasterol, and campesterol [19]. Additionally, a distinctive triterpene, beta-amyrin, has been identified as one of its chemical constituents, showcasing the plant's diverse chemical profile. The plant Tridax procumbens has been a source of diverse and interesting compounds, including luteolin, beta-amyrin, beta-amyron, lupeol, triacontanol, fucosterol, campasterol, stigma sterol, as well as fatty acids such as arachidic acid, lauric acid, and palmatic acid. Flavones and glycosides have also been identified in the plant. Additionally, the flowers yield steroidal saponin, specifically characterized as b-sitosterol 3-O-b-D-xylopyranoside [20]. The total phenolic content was measured as gallic acid equivalent (GAE) in milligrams per gram of dry plant extract using the formula: C = c x V/m. These compounds contribute to the plant's medicinal and pharmacological properties. [21] The proximate

analysis of Tridax procumbens reveals a rich content of sodium, potassium, and calcium. The leaves primarily consist of 26% crude proteins, 17% crude fiber, 39% soluble carbohydrates, and 5% calcium oxide. Additionally, compounds such as luteolin, glucoluteolin, quercetin, and isoquercetin have been identified in its flowers. Furthermore, fumaric acid, beta-sitosterol, and tannins have also been reported in various parts of the plant, highlighting its diverse chemical composition. [22][25] The flower extract of Tridax procumbens contains b-Sitosterol-3-O-b-Dxylopyranoside. Tridax is rich in phenolic content, measuring 12 mg/g GAE (gallic acid equivalent). Oleanolic acid, present in significant quantities, exhibits potential as an anti-diabetic agent, demonstrated through its inhibitory activity against glucosidase. The presence of the flavonoid quercetin has been confirmed through HPLC and HPTLC studies of the plant's ethanolic extract, which align with the profile of standard quercetin. [23] Various compounds have been isolated from Tridax procumbens, including methyl 14-oxoacagaecunoate, methyl 14-oxononacosanoate, 3-methyl-nonadecylbenzene, heptacosanyl cyclohexane carboxylate, 1-(2,2-dimethyl-3-hydroxypropyl) isobutyl phthalate, 12-hydroxytetracosa-15-one, 32-methyl-30-oxotetraatriacont-31-en-1-ol, as well as β-amyrin, β-amyrone, fucosterol, and sitosterol. Additionally, fatty acids such as arachidic, behenic, lauric, linoleic, linolenic, myristic, palmitic, and stearic acids have been identified in the plant. [26] Twenty-three known flavonoids were identified in Tridax procumbens, with apigenin (29.00%), quercetin (21.67%), and kaempferol (11.20%) being the major constituents. Other flavonoids present included (-)-epicatechin (6.38%), naringenin (4.82%), (+)-catechin (3.28%), biochanin (3.21%), robinetin (3.13%), diadzein (2.57%), and nobiletin (2.07%). Treatment with these flavonoids significantly reduced alkaline phosphatase (54.91-100.52%), aspartate transaminase (37.74-64.79%), and alanine transaminase (32.96-57.82%) activities in a dose-dependent manner compared to the control group. [24]

**Toxicity Studies**

The assessment of the substance's toxicity employs the "Staire case" method, involving the determination of LD in both rats and mice, administered through oral and intraperitoneal routes. Initial dosages consist of 2000 mg/kg for oral administration and 800 mg/kg for intraperitoneal administration in both species.

In acute toxicity studies, mice are subjected to a dose of 250 mg/kg of dried extract, and their motor reflexes are diligently observed for a duration of 48 hours. This acute toxicity study is conducted over a period of 15 days, allowing for a comprehensive understanding of the short-term effects and reactions. For chronic toxicity investigations, two groups of subjects are administered a daily dose of 250 mg/kg extract for 15 days. Remarkably, no instances of mortality are observed, and the behavioral patterns of the subjects remain unaffected throughout the study period. This chronic toxicity assessment provides valuable insights into the substance's prolonged exposure effects, contributing to a more comprehensive safety profile. [27]

**Pharmacological Activity**

**1. Antimicrobial Activity**

Antimicrobial screenings of T. procumbens have yielded promising results, demonstrating sensitivity of various bacteria and fungi to its antimicrobial properties. However, it is crucial to note that additional studies are required to validate and further substantiate these findings.

A recent development involves the utilization of callus from the stem and leaf, showcasing its efficacy in synthesizing silver nanoparticles. These nanoparticles exhibit some level of antimicrobial activity against bacteria such as E.

coli, V. cholerae, and fungi including A. niger and A. flavus (Bhati-Kushwaha and Malik, 2014). It's noteworthy to mention that, while promising, the observed activity was comparatively lower than that demonstrated by silver nitrate. As a result, further research is essential to draw conclusive insights into the antimicrobial potential of T. procumbens and its derivatives. The antibacterial activity of T. procumbens has been explored through various extracts. Petroleum ether and ethanolic extracts from its leaves exhibited antibacterial effects against Bacillus faecalis, potentially attributed to the presence of alkaloids. Additionally, chloroform extracts demonstrated antibacterial activity against B. faecalis, B. subtilis, E. coli, and Pseudomonas aeruginosa (Christudas et al., 2012). It's important to note that these experiments require improved controls and detailed procedural descriptions. Furthermore, the essences extracted from T. procumbens reveal the presence of alpha and beta pinenes, known to be effective in treating bacterial and fungal infections when used in small quantities (Manjamalai et al., 2012b). Despite some contradictory results in the literature (e.g., Policegoudra et al., 2014; Taddei and Romero, 2002), indicating varying degrees of antimicrobial activity, there is potential for T. procumbens as an antimicrobial agent. However, more comprehensive studies are necessary in this domain to establish conclusive evidence. [28]

**2. Anti-Cancer**

Several studies have indicated the cytotoxic properties of specific compounds found in T. procumbens. Notably, -pinene, along with -pinene and other terpenes, demonstrated cytotoxicity on cancer cells (103). The strong cytotoxic activity of - and -pinenes has been reported on various cell lines, including breast cancer and leukemic cells, with anti-prostate cancer effects (104). The essential oil of T. procumbens contains major bioactive compounds, including -pinene, -pinene, l-phellandrene, and Sabinene, which have been identified and studied for their preventive and chemotherapeutic effects on experimentally induced lung cancer development. The essential oil, composed of 14 compounds, emphasizes -pinene, -pinene, phellandrene, and Sabinene as major components with potential applications in cancer treatment.

The essential oil of T. procumbens exhibited high cytotoxicity, causing cancer cell death within 24 hours at a concentration of 50 g. This underscores the potent impact of the essential oil on eliminating B16F-10 cells in vitro. Furthermore, in an in vivo drug toxicity study, even at its highest dosage, the essential oil did not induce any lethal effects or abnormalities in C57BL/6 mice. With a selected minimal dose of 50 g for anti-cancer studies, it is inferred that the synergistic effects of T. procumbens essential oil contribute to the chemoprevention of lung cancer development in B16F-10-injected mice, making it a potentially valuable drug for cancer treatment.

The aqueous extract of T. procumbens leaves has demonstrated efficacy in treating and preventing carbon tetrachloride-induced hepatic cytotoxicity. The results indicate that daily oral consumption of the extract acted prophylactically against carbon tetrachloride poisoning. This aligns with the traditional use of T. procumbens. [29]

**3. Antifungal Activity**

The antifungal potential of T. procumbens has been assessed through diverse extraction techniques to identify the most effective zone of inhibition against various fungal strains, including Microsporum fulvum, Microsporum gypseum, Trichophyton mentagrophytes, Trichophyton rubrum, Candida albicans, and Trichosporon beigelii. Extracts from the plant's aerial parts exhibited activity against dermatophytes, with inhibition zones ranging from 17 to 25mm, and the dichloromethane (DCM) fraction displayed the most significant response (Policegoudra et al., 2014). However, the identification of specific

bioactive compounds responsible for the antifungal properties, suggested to be fatty acid derivatives and constituents, lacks supporting evidence according to the authors. [28]

**4. Anti-bacterial**

The demand for plants with antimicrobial potential has driven extensive research, with hundreds of plant species tested for such properties, although many remain insufficiently evaluated. Traditional medicinal plants are emerging as promising sources of new antimicrobial agents, and numerous studies have reported the antibacterial activities of local plants. The escalating global issue of multidrug-resistant superbugs, particularly in hospital settings, is a consequence of the indiscriminate and irrational use of antibiotics. In the case of Tridax, the antimicrobial potential was assessed using methanolic and water extracts, with the methanolic extract proving more effective against all bacteria. The presence of β-amyrin in the plant's leaves is suggested as a potential contributor to its antimicrobial activity. Various studies on Tridax's antibacterial activity have demonstrated effectiveness against Pseudomonas, Klebsiella pneumoniae, Proteus vulgaris, E. coli, Staphylococcus aureus, as well as the fungi Aspergillus niger and Candida albicans [27].

**5. Antioxidant**

Free radicals, characterized by unpaired electrons in atomic orbitals, are highly reactive molecules posing potential harm to biological systems. Among these radicals are hydroxyl radicals (OH), superoxide anion radicals, hydrogen peroxides, reactive oxygen species (ROS), and peroxyl radicals. Their instability can inflict damage on vital biomolecules, including DNA and macromolecules, leading to cellular damage and disruptions in homeostasis.

Antioxidants, or free radical scavengers, play a crucial role in mitigating this activity by preventing oxidation within biological systems. Tridax procumbens has been explored for its antioxidant potential, revealing significant activity akin to Ascorbic acid in ethyl acetate and n-butanol fractions derived from methanolic extracts. The 1,1-diphenyl-2-picrylhydrazyl (DPPH) method demonstrated a high percentage antioxidant activity of 96.70% at a concentration of 250 µg/mL, with a noteworthy reductive potential of 0.89 nm compared to the standard (0.99 nm). Various studies around the world have identified many new plant constituents with antioxidant activity, among these being polyphenols. Tridax procumbens, with its rich content of phenols, flavonoids, anthraquinone, carotenoids, and vitamins A and C, emerges as a promising natural source of antioxidants with potential medicinal value. The hepatoprotective nature of the plant is attributed to flavonoids, known for their free radical scavenging properties. Tridax procumbens extends its therapeutic potential to reducing lipid peroxidation and inducing enzymatic and non-enzymatic antioxidants. Studies highlight its strong antioxidant activity, making it a valuable candidate for addressing inflammation and cancer with potentially lower toxic effects. For instance, the plant extract has demonstrated efficacy in reducing carrageenan-induced rat paw inflammation, outperforming aspirin in certain dosages without causing ulceration. Additionally, Tridax procumbens has shown positive effects in reducing neuropathic and inflammatory pain in rodent models. Overall, the comprehensive antioxidant and anti-inflammatory properties of Tridax procumbens underscore its potential in various medicinal applications. [28].

**6. Anti-inflammatory**

The quest for safer alternatives to drugs addressing pain and inflammation intensifies, driven by considerable adverse effects associated with existing medications [153]. Exploring the therapeutic potential of plants with traditional

applications for pain relief remains a promising research strategy [154, 155]. Tridax procumbens has emerged as a noteworthy candidate, displaying significant anti-inflammatory properties, impacting key indicators such as exudates, leucocyte migration, rat paw edema, and granuloma formation. The observed anti-inflammatory action in Tridax is hypothesized to result from a corticotrophic influence, substantiated by an increase in weight.

The intricate involvement of prostaglandins in causing gastric ulcers has been a subject of investigation. Notably, Tridax exhibits a notable characteristic of not causing ulcers, suggesting a less significant role of prostaglandins in its anti-inflammatory effect. Furthermore, Tridax procumbens has been evaluated in various pain models, including formalin-induced persistent pain, acetic acid-induced writhing, and Complete Freund's Adjuvant (CFA)-induced hyperalgesia in rats, comparing its effects against the standard Diclofenac Sodium. Mechanical hyperalgesia measurements at different time intervals reveal that Tridax-400mpk in Normal Saline vehicle demonstrates a 95±09% reversal in Biphasic pain. In peripheral pain, it exhibits a 78±07% reversal, while in inflammatory pain, the reversal is noted at 27±8%. The percentage reversal is calculated as 100 – (Average response of the test drug / Average response of the vehicle * 100). It is noteworthy that the oral administration of Tridax procumbens extract significantly reduces mechanical hyperalgesia in CFA-injected rats. The anti-nociceptive property of the extract is attributed to the presence of flavonoids and phytosterols in the plant, with the suggestion that isolated compounds such as procumbentin and quercetin, along with sterols like β-sitosterol, may exhibit more pronounced analgesic activity compared to the extract, particularly in various pain models.

## 7. Antidiabetic Properties

Tridax procumbens has demonstrated promising antidiabetic properties in various studies, positioning it as a potential candidate for managing diabetes. In experiments involving Streptozotocin-induced diabetic rats, ethanolic extracts from the entire plant exhibited antidiabetic activity comparable to the well-known diabetes drug Glibenclamide. This extract not only significantly lowered blood glucose levels but also showed positive effects against hyperlipidemia associated with diabetes mellitus. The study included appropriate controls and multiple concentrations of Tridax extract, providing robust evidence of its efficacy (Petchi et al., 2013). In another investigation using Alloxan-induced diabetic rats, methanolic extracts of T. procumbens outperformed Glibenclamide in reducing blood glucose levels. Rats treated with different doses of plant extract showed a notable decrease in blood glucose levels, with no observed adverse side effects. The study also evaluated the impact of Tridax extracts on body weight, revealing its potential benefits in managing diabetes-induced weight changes (Pareek et al., 2009). Additionally, a study by Bhagwat et al. (2008) explored the effects of oral administration of aqueous and alcoholic extracts from Tridax leaves on Alloxan-induced diabetic rats. The extracts significantly decreased blood sugar levels in a seven-day regimen, further supporting the antidiabetic potential of Tridax. The mechanism behind Tridax's antidiabetic effect involves the inhibition of alpha-amylase and alpha-glucosidase enzymes, crucial players in carbohydrate metabolism. The extracts slowed the activity of these enzymes, mimicking the action of common drugs used in diabetes treatment. By retarding the breakdown of carbohydrates, Tridax may contribute to reducing the insulin demand, a pivotal factor in diabetes mellitus (Sonawane et al., 2014). These collective findings underscore the pharmacological promise of Tridax in diabetes

management, prompting the need for further research and clinical studies to evaluate its effects in human subjects.

**8. Wound healing**

The impact of the indigenous drug Tridax on developing granulation tissue in rats was examined over a period of 32 days post-wounding at 4-day intervals. Notably, lysyl oxidase activity, protein content, specific activity, and breaking strength were all elevated in animals treated with the drug compared to controls. However, a decline in lysyl oxidase activity was observed in drug-treated animals after day 8. This suggests a dual role for the drug, with a stimulatory (direct) effect in the initial phase of wound healing and a depressant (indirect) effect in the later stage (Bhagwat et al., 2008). Tridax demonstrated an antagonistic effect on the antiepithelization and tensile strength depressing actions of dexamethasone, a known healing suppressant agent, without impacting the anti-contraction and antigranulation actions of dexamethasone (Bhagwat et al., 2008). Moreover, various extracts of Tridax, including whole plant extract, aqueous extract, butanol extract, and ether fraction, were studied in a dead space wound model. The whole plant extract exhibited the most significant pro-healing activity, leading to increased tensile strength and lysyl oxidase activity in both normal and immunocompromised (steroid-treated) rats in the dead space wound model. The plant not only increased lysyl oxidase but also protein and nucleic acid content in the granulation tissue, possibly due to an increase in glycosaminoglycan content (Bhagwat et al., 2008). While the findings highlight the potential of Tridax in promoting wound healing, it's worth noting that the human application (Kshudra-shevantika) showed less significant ulcer healing compared to the Jatyadi taila.

**9. Hepatoprotective Activity**

The aerial parts of Tridax exhibit significant hepatoprotective activity, particularly in mitigating D-Galactosamine/Lipopolysaccharide (D-GalN/LPS) induced hepatocellular injury (Bhagwat et al., 2008). D-GalN/LPS is known to be hepatotoxic, causing the destruction of liver cells. The multifocal necrosis induced by D-GalN shares similarities with the lesions observed in viral hepatitis in humans. D-GalN is recognized for selectively blocking transcription and indirectly inhibiting hepatic protein synthesis. As a consequence of endotoxin toxicity, it triggers fulminant hepatitis, often manifesting within 8 hours after administration (Bhagwat et al., 2008).

**10. Immunomodulatory Activity**

Ethanolic extracts of Tridax leaves demonstrate an immunomodulatory effect in albino rats exposed to Pseudomonas aeruginosa, concurrently inhibiting the proliferation of the same bacteria (Bhagwat et al., 2008). Notably, there is a significant increase in the phagocytic index, leukocyte count, and spleenic antibody-secreting cells attributed to the ethanol-insoluble fraction of the aqueous extract of Tridax. This suggests a stimulation of the humoral immune response, as evidenced by the elevated hemagglutination antibody titer. The study underscores the immunomodulatory influence of Tridax on both the humoral and cell-mediated immune systems (Bhagwat et al., 2008).

## CONCLUSION

In conclusion, the review of Tridax procumbens underscores its multifaceted pharmacological potential and diverse applications across various health-related domains. Tridax procumbens, commonly known as coat button or 'Jayanti,' has been investigated for its therapeutic properties, revealing a rich source of bioactive compounds with significant pharmacological activities.

The plant exhibits notable antioxidant properties attributed to compounds such as polyphenols and flavonoids, offering potential benefits in countering oxidative stress-related ailments. Moreover, Tridax procumbens has demonstrated

anti-inflammatory effects, presenting a promising natural alternative for conditions associated with inflammation. Its analgesic properties further support its potential as a source of pain relief.

Tridax procumbens has showcased antimicrobial activities against various bacteria and fungi, suggesting its utility in combating infections. Additionally, its immunomodulatory effects highlight its role in influencing both humoral and cell-mediated immune responses, contributing to overall immune system regulation.

The plant has proven effective in wound healing, with studies indicating its role in stimulating granulation tissue development and enhancing lysyl oxidase activity. Furthermore, Tridax procumbens exhibits antidiabetic properties, showcasing potential benefits in managing diabetes and associated complications.

While the plant demonstrates promising pharmacological activities, it is crucial to note the need for further research, especially clinical studies, to validate its efficacy and safety in human applications. Tridax procumbens stands out as a valuable natural resource with a wide array of potential health benefits, warranting continued exploration and investigation for its integration into traditional medicine and pharmaceutical practices.

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