

UNLOCKING THE PHARMACOLOGICAL SECRETS OF TRIDAX: A PROMISING HERBAL REMEDY

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INTRODUCTION:

Tridax procumbens L. also known as coat buttons is a perennial plant from the Asteraceae family that originated in central America but now can be found throughout the tropics and subtropics. It is a highly valuable plant with a maximum number of pharmacological activity and is one of the essential ingredients in most of the compound preparations of Ayurvedic literature.[1]

It is a small, semi prostrate, annual or perennial, and herbaceous creeper weed having short, hairy blade-like leaves. The collar is yellow in color. The stem is elongated to the height of 20-60 cm tall, branched, sparsely hairy, rooting at nodes. Leaves are simple, opposite, stipulate, lanceolate, or ovulate. 4-8 cm long, toothed margin, base wedge-shaped, short and petiole, hairy on both surfaces. Flowers are tubular, yellow with hairs, and inflorescence capitulum. The plant is screened for the presence of phytochemical constituents, and anti-oxidant properties, and results obtained from this investigation have aided in the rationalization of the medicinal use of this plant. [2]



Table-1: Classification

Divisions	Classification
Kingdom	Plantae

Sub kingdom	Tracheobionta
Division	Spermatophyta
Subdivision	Magnoliophyta
Class	Magnoliopsida
Sub class	Asteridae
Order	Asterales
Family	Asteraceae
Genus	Tridax
Species	Procumbens

Table-2: Common names

Tridax daisy	English
Ghamra	Hindi
Jayanti veda	Sanskrit
Dagadi pala	Marathi
Gaddi chemanthi	Telugu
Thata poodu	Tamil
Chiravanak	Malayalam

Table-3: Phyto chemical constituents

Extraction	Plant part	Compounds
Chloroform extract and chloroform water extract	leaves	Steroid, saponin, coumarins, alkaloids, amino acids, diterpenes, phenol and flavonoids, phlobatannin.
Acetone-water extract and acetone extract	leaves	Steroid, tannin, saponin, anthocyanin, coumarins, alkaloids, diterpenes, phenols and flavonoids, proteins, carbohydrates,

		antioxidant property.
Methanol extract	leaves	Alkaloids, tannins, anthocyanins, proteins saponins, steroid phlobatannin, terpenoids, flavonoids, amino acids, phenols and cardiac glycosides, antibacterial activities, antioxidant properties.
Ethanol extract	Whole plant	Flavonoid, quercetin, alkaloids, tannins, saponins and phenolic compounds.
Acetone extract	Roots, leaves	Antibacterial activity.
Aqueous extract	leaves	Blood clotting properties.
Petroleum ether and ethanolic extract	Whole plant	Antibacterial activity against B. faecalis due to presence of alkaloids ,tannins , steroids, purines, carbohydrates, proteins.
Chloroform extract	Whole plant	Against B .faecalis and E. coli.
Aqueous extract	leaves	DPPH radical scavenging activity (micro gram/ml)
Ethanol extract	leaves	Poly phenol content, flavonoids, antibacterial activity against pseudomonas aeruginosa.
Methanol extract fractioned with dichloromethane (DCM)	Aerial parts of plant	9,12-octadecadiemoic acid ethyl ester (18.04%), 5-cholestane (12.42%), hexadecenoic acid ethyl

		ester(4.86%) and 9-octadecenoic acid ethyl ester(4.72%). Cholestane glycosides and rhamnosides are known for their potent cytotoxicity against malignant tumor cells.
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DISCUSSION

TABLE 4 : PHARMACOLOGICAL PROPERTIES OF TRIDAX PROCUMBENS

Pharmacological property	Active against	Phytochemicals responsible for the activity	Extraction procedure
Antifungal activity	C.Albicans	Phenols, flavonoids, saponins, sterols, and fatty acids , puerarin, esceletin, oleanolic acid, betulinic acid , centaurein, bergenin and centaureidin. Bioactive compounds 9,12 octadecadienoic acid ethyl ester, cholestane, , hexadecaenoic acid ethyl ester and 9-octadecaenoic acid ethyl ester.	Methanol extract, diluted cardiomyopathy (DCM) fraction.
Antioxidant activity	DPPH(1,1-dipehnyl,2-picryl hydrazyl)	Phenolics, proteins, vitamins, flavonoids, tannins, catechins and pectins.	Ethyl acetate and n-butanol
Anti-inflammatory activity	COX-1 and COX-2	Centaurein, and bergenin, flavonoids and other	Ethyl acetate extract

		polyphenols	
Antibacterial activity	Staphylococcus aureus, klebsiella pneumoniae, Salmonella typhi, Escherichia coli and bacillus cereus	Alkaloids, flavonoids, glycosides and other aromatic compounds	Methanol and ethyl acetate extract
Anticancer activity	Potent cytotoxic activity against malignant tumour cells	5 α -cholestane, monoterpenes(alpha and beta pinenes)	Crude flower aqueous and acetone extracts
Hepatoprotective activity	Reduced levels of aspartate transaminase, alanine transaminase, alkaline phosphate, lactate dehydrogenase and gamma glutamyl transferase and bilirubin	Flavanoids, procumbenetin	95% ethanol extract

MEDICINAL USES:

Antimicrobial activity: The whole plant of *Tridax* is having antibacterial activity.[3]

The methanolic and ethyl acetate extract of *Tridax procumbens* were tested against various bacterial species using the Disc diffusion Agar well diffusion method. The ethyl acetate extract was more effective than the methanolic extract in both methods. The ethyl acetate extract showed a greater zone of inhibition against *Staphylococcus aureus*, *Salmonella typhi*, and *Bacillus cereus* species, whereas, in the methanolic extract of *Tridax procumbens*, only *Escherichia coli* showed a significant zone of inhibition, in disc diffusion method. In the agar gel diffusion method, the methanolic extract of *Tridax procumbens* showed antimicrobial

activity for *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Salmonella typhi*, and *Escherichia coli* and the ethyl acetate extract showed significant zone of inhibition against *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Salmonella typhi*, *Escherichia coli* and *Bacillus cereus*. *Tridax procumbens* leaf, extracted with ethyl alcohol, is most effective as an antimicrobial agent against *Pseudomonas vulgaris*. The ethanolic extract showed very good antibacterial activity against gram-negative, non-fermenting multidrug-resistant *Pseudomonas* isolated from nosocomial infections may be due to the presence of phytoconstituents such as flavonoids and tannins have several mechanisms of action such as inhibition of DNA gyrase, inhibition of cytoplasmic membrane function, and inhibition of energy metabolism (Pai C, et al., 2011).

The extract of *Tridax procumbens* L. was thus found effective against both Gram-positive and Gram-negative bacteria.[4]

Petroleum, ether, and ethanolic extracts of leaves of *T. procumbens* showed antibacterial activity against *Bacillus faecalis*. This activity was reported to be probably due to the presence of alkaloids.[5]

Repellency Activity: Essential oils extracted from leaves of *Tridax procumbens* Linn. by steam distillation after examination for its topical repellency effects against malarial parasite *Anopheles stephensi* in mosquito cages at three different concentrations (2%, 4%, and 6%), exhibited relatively high repellency effect (>300 minutes at 6% concentration) (Rajkumar S and Jebanesan AJ, 2007). [6] The water and ethanol decoctions were also reported to have anti-plasmodial properties against chloroquine-resistant *Plasmodium falciparum* (Ghosh P, et al., 2019). [7]

The repellency activity is due to chemical constituents α -Terpinene, α -Terpineol and β -Pinene which are present in the plant.[8]

Antihypertensive Activity; Vasodilatation can be facilitated by the inhibition of vasoconstriction and secretion of relaxant factors from vascular endothelium. *T. procumbens* leaves have been reported to contain several active compounds such as alkaloids, flavonoids, quercetin, arachidic, and linoleic acid. Quercetin has been known to decrease Blood Pressure (BP) and/or reduced the severity of hypertension in spontaneously hypertensive rats (Carlstrom J, et al., 2007).[9] The flavonoid luteolin has also induced NO production and arterial relaxation (Si H, et al., 2014).[10] The aqueous extract of the leaves of *T. procumbens* was evaluated for assessing their relaxation effect in the aortic artery that was pre-contracted with

Phenylephrine (PE) and KCl by the mechanistic interactions with Nitric Oxide (NO) synthase, cyclic Guanosine Monophosphate (cGMP), and cyclic Adenosine Monophosphate (cAMP). The results showed that the TPE significantly reduced the contraction induced by PE in a concentration-dependent manner. A part of the relaxing effect of Tridax is mediated directly by blocking or modulating cGMP and cAMP (Salahdeen HM, et al., 2016).[11] The effect of Tridax procumbens Aqueous Leaf Extract (TPALE) was also investigated on reproductive function in N nitro-L-arginine-methyl ester (L-NAME) induced hypertensive rats. The results proved that TPALE decreased systolic, diastolic, and mean arterial blood pressure in L-NAME+TPALE treated groups compared to only L-NAME treated group (Salami SA, et al., 2017).[12]

The phytochemicals, alkaloids, and flavonoids present in ethyl acetate and dichloromethane fractions are responsible for the lowering of blood pressure. flavonoids can be responsible for vasorelaxation, which helps lower blood pressure. It is also said that flavonoids may have a diuretic effect that may also explain part of the plant's antihypertensive activity.[13]

Anti-inflammatory Activity; . Extract of tridax procumbens showed significant anti-inflammatory activity as compared to the standard drug of Ibuprofen (NSAIDS). The extract of T. procumbens at a dose of 400mg/Kg bw inhibits up to 52.50% in the first, 44.12% in the third, and 25% in the fifth hours.[14]

The most active fraction of T. procumbens responsible for anti-inflammatory activity is the Ethyl Acetate (ETA) fraction as it contains moderate polar natural products like alkaloids and flavonoids. The alkaloids and flavonoids can counteract Reactive Oxidative Species (ROS) involved in the pathogenesis of inflammation and related ailments in biological systems.[15]

Water soluble powder of Tridax leaf extract was administered orally at different doses to rats. The results demonstrated that the extract possessed analgesic activity. Tridax procumbens L. dose reduced the abdominal writhing Tridax alcoholic and hydro-alcoholic extract of anti-inflammatory activity by using the rat-paw edema assay and showed edema inhibition in the percentage of 10.82, 16.80, and 11.39. [16]

The anti-inflammatory activity of Tridax procumbens of aerial parts could be at least in part due to COX-1 and COX-2 enzyme inhibition and free radical scavenging activities may be attributed to the presence of flavonoids and other polyphenols in the extract.[17]

Wound healing activity:

The whole Plant Extract (WPE) of *Tridax procumbens* demonstrated the greatest pro-healing activity as evidenced by the increase in tensile strength and lysyl oxidase activity after being studied on a dead space wound in an albino rat. The mechanism of the wound healing process of this plant material involves a complex interaction between dermal and epidermal cells, the extracellular matrix, controlled angiogenesis, and plasma-derived proteins all coordinated by an array of cytokines and growth factors. The prohealing action of the plant may be attributed to the presence of fumaric acid (Udupa AL, et al., 1995). The aqueous and ethanolic extracts of the whole plant of *Tridax procumbens* Linn. were also evaluated for wound healing activity. The ethanolic extract was quite more effective in increasing wound contraction compared to the aqueous extract. The topical application of an ethanolic extract of the plant showed significantly higher tensile strength than the aqueous extracts. Both the plant extracts have increased granulation and hexosamine formation and showed a significant increase in the granulation tissue's hydroxyproline content, indicating rapid collagen formation.[18]

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The traditionally used form of *Tridax* that is paste is found to be most useful for wound healing purposes. Another useful dosage form of *Tridax* is found as its Ash.[20]

Antidiabetic activity: oral administration of aqueous and alcoholic extracts from the leaves of *T. procumbens* significantly decreased blood sugar levels in Alloxan-induced Wistar diabetic rats. The administration of aqueous and alcoholic extracts from the leaves of *Tridax procumbens* (200 mg/kg) orally for 7 days produced a significant decrease in the blood glucose level in the alloxan-induced diabetic rat model (Bhagwat DA, et al., 2008). [21]The ethanolic extract of the whole plant of *T. procumbens* also showed significant anti-diabetic and anti-hyperlipidemic activities against streptozotocin-induced diabetes in rats. Administration of ethanolic extract of the whole plant of *T. procumbens* to diabetic rats also resulted in an increase in their body weight. Flavonoids present in the plant regenerate the damaged beta cells of the pancreas, and the polyphenolic compounds and saponin inhibit glucose transport by

inhibiting sodium glucose co-transporter-1 (S-GLUT-1) in the intestine (Petchi RR, et al., 2013).[22]

T. procumbens methanol extract of 50 percent of acute and sub-chronic doses administered by oral shows to reduce fasting blood glucose levels in diabetic rats. This plant material does not affect the sugar levels in normal rats.[23]

Antifungal activity: The antifungal activity of *T. procumbens* may be due to the presence of many bioactive compounds such as phenols, flavonoids, saponins, sterols, and fatty acids. The essential oils obtained from the flowers of *Tridax procumbens* L. were found to be active against the tested fungi (Joshi RK and Badakar V, 2012).[24] Methanol extract fractionated with dichloromethane has produced zones of inhibition ranging from 17 to 25 mm against various fungal strains including *Microsporum fulvum* (MTCC 8478), *Microsporum gypseum* (MTCC 8469), *Trichophyton mentagrophytes* (MTCC 8476), *Trichophyton rubrum* (MTCC 8477) and *Candida albicans* (MTCC 854). Among all other species *C. albicans* was highly susceptible. The anti-dermatophytic activity of the DCM fraction may be attributed to the presence of unsaturated fatty acids, 5-cholestane, and different siloxanes (Policegoudra RS, et al., 2014).[25] *Tridax procumbens* also possesses antifungal properties against three phytopathogenic fungi i.e. *Helminthosporium oryzae*, *Rhizoctonia solani* and *Pyricularia oryzae*. The flowers also have excellent inhibitory potential against the tested plant pathogen, *Fusarium oxysporum*. Free flavonoids and sterols of *T. procumbens* (flower) have also completely inhibited the spore germination of the fungi (Sharma B, Kumar P, 2009).[26]

Antioxidant activity: Fractions of methanolic extract from the aerial part were screened for antioxidant activity by the DPPH method. The Ethyl acetate and n-Butanol fractions had shown significant activity which is comparable to the activity of standard antioxidant Ascorbic acid.[27] The strong anti-oxidant activity of *T. procumbens* is due to the high content of phenols, flavonoids, anthraquinone, carotenoids, and vitamins A and C, Phenols and flavonoids have long been recognized to possess anti-inflammatory, antiallergic, and hepatoprotective, antithrombotic, antiviral, and anticarcinogenic activities.[28]

Habila et al., (2010) found a 96.7% antioxidant activity at a concentration of 250 µg/mL (ethanolic extract) which was observed to be higher than that of gallic acid (92.92) and ascorbic acid (94.81) used as standards..The authors report a high reductive potential in *Tridax* (0.89 nm) compared to the standard (0.99nm) and postulate that this strong antioxidant activity could

be due to the high phenol content of the plant, making this plant a good natural source of antioxidants with potential medicinal value.[29]

Antidiarrheal activity: Root decoction of the plant is used in case of infantile diarrhea.[30] The presence of tannins, terpenoids, and cardiac glycosides in *Tridax procumbens* leaf is suggestive of its potent bioactivity. The presence of tannins suggests the ability of this plant to play a major role as an antidiarrhoeic and antihemorrhagic agent.[31]

Conclusion: *Tridax procumbens* has some beneficial properties, such as its medicinal uses in traditional medicine. Its medicinal properties hold potential for further exploration, but more research is needed to validate its effectiveness and ensure its safety. It contains various bioactive compounds with potential pharmacological properties. It has been used in traditional medicine for its anti-inflammatory, analgesic and anti-fungal properties. *Tridax procumbens* can stimulate the proliferation of fibroblasts, enhance collagen synthesis and accelerate the formation of new blood vessels, thereby aiding in the healing process. *Tridax procumbens* has been used in reclamation projects and afforestation programs to stabilize soils and control erosion in areas prone to degradation. It has attracted the attention of researchers and scientists due to its diverse pharmacological properties. It has the ability to spread rapidly and cooperate with crops for nutrients and sunlight.

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