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Pharmacognostical and Pharmacological Review on *Tridax procumbens* Linn.

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Abstract

Tridax procumbens Linn is a wild plant, found throughout India and is native of tropical America and naturalized in tropical Africa, Asia and Australia. It has been extensively used in Ayurvedic system of medicine and is dispensed as “Bhringraj” by some practitioners of Ayurveda. It has been found to possess significant medicinal properties against blood pressure, malaria, dysentery, diarrhoea, stomachache, headache, wound healing, it also prevents hair fall etc. Its flowers and leaves possess antiseptic, insecticidal and parasiticidal properties. The plant also shows various Pharmacological activities like immunomodulatory, antidiabetic, anti-hepatotoxic, anti-oxidant, anti-inflammatory, analgesic, and marked depressant action on respiration. The phytochemical screening of *Tridax procumbens* revealed the presence of alkaloids, carotenoids, flavonoids (catechins and flavones), saponins and tannins etc. The phytoconstituents present in them are responsible for the biological activities. These reviews focus on phytochemicals and pharmacological activities of *Tridax procumbens*.

Keywords: *Tridax procumbens*, coat button, antibacterial, anticancer, anti-diabetic

Introduction

Herbal medicines also known as Herbalism or Botanical medicines are used for their multi-target therapeutic or medicinal value. Many of the medications of the twenty century were developed from the knowledge of traditional healings (with specific plants) that treats many health problems. Folk drugs are an important source of Ayurveda, Unani and ancient Chinese medicine. Some vendors and v aids are still practicing folk medicines in remote areas and are surprisingly found high curative value. The use of herbal medicine is extensively practiced in developing countries and also in developed countries; the demand for the same is high in recent years. A WHO report stated that among 119 plants derived pharmaceuticals medicines, about 74% are employed in modern medicine in a way that directly related to their traditional uses as plant medicines by native traditional cultures. Many of the pharmaceutical firms are presently conducting extensive analysis and research on plant materials collected from the rainforests and other places for their potential medicinal value.

Origin and Distribution

Tridax procumbens Linn. is native of tropical America and naturalized in tropical Africa, Asia, Australia and India. This wild herb is distributed throughout India. Coat buttons are found on roadsides, waste grounds, railroads, dykes, riverbanks, meadows, and dunes. Its widespread distribution and importance as a weed are because of its spreading stems and plentiful seed production.

Description

Tridax procumbens Linn. usually called as ‘Ghamra’ and in English popularly referred as ‘coat buttons’. It is extensively utilized in an Ayurvedic system of medicine for varied ailments and is dispensed as “Bhringraj” by some of the practitioners of Ayurveda which is well-known medicine for liver disorders [1].

Macroscopic characters of leaf, flower, stem and root Leaf

Leaves are 3-6 cm long and 1-4 cm wide, lanceolate to ovate shaped, hairy, opposite, often deeply lobed with irregularly toothed margin and an acute apex. Flowers were of two types, disc flowers, the corolla narrow-campanulate, 8 mm long, bright yellow and hairy at the top, with spreading pappus of plumose hairs.

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Ray flowers 5 or 6, female, with narrow corolla tube and brown ligulate limb, white or pale yellow, flowering and fruiting throughout the year. The Stem was herbaceous, cylindrical, decumbent and branched. *Tridax procumbens* having a tap root system ^[2] (Table 1).

Table 1: Macroscopy of *Tridax procumbens* Linn.

Plant part	Morphology of leaves	Observation
Leaf	Colour	Green
	Odour	Characteristic
	Taste	Acrid
	Size	3-7 cm long, 1-5 cm wide
	Shape	Lanceolate to ovate
	Texture	Short
	Fracture	Easy
	Apex	Acute
	Arrangement	Opposite
Appearance	Rough & Scabrous	
Stem	Colour	Green
	Odour	Characteristics
	Taste	Acrid
	Size	23-46 cm
	Shape	Cylindrical
	Texture	Smooth
Root	Fracture	Soft
	Colour	Brown
	Odour	Characteristics
	Taste	Acrid
	Size	15-32 cm
	Shape	Tortous
	Fracture	Soft

Classification

Kingdom: Plantae – Plants

Sub kingdom: Tracheobionta – Vascular plants Division: Spermatophyta

Subdivision: Magnoliophyta – Flowering plants Class: Magnoliopsida – Dicotyledons

Subclass: Asteridae Order: Asterales

Family: Asteraceae – Aster family Genus: *Tridax* L. – tridax

Species: *Tridax procumbens* L. – Coat buttons

Hindi: Khal muriya, Tal muriya, Ghamra Sanskrit: Jayanti Veda

English: Coat buttons, *Tridax* Daisy, Wild daisy Oriya: Dagadi pala

Marathi: Gaddi Chemanthi Tamil: Vettukaya thalai, Thatha

Telugu: Gayapu aku, Gaddi chamanthy or Palaka aku.

Quantitative Microscopy

Quantitative microscopy includes stomatal number, stomatal index, palisade ratio, vein-islet number and vein termination number. The value obtained for leaf constant is tabulated in (Table 2).

Table 2: Quantitative microscopy

Sample identity	Stomatal index		Vein-islet No. Per mm ³		Vein termination No. Per mm ³	
	Upper	lower	Upper	lower	Upper	lower
Leaves	30.12	36.31	32.33	20.66	32.66	19.66

Physicochemical parameters

Physicochemical parameter includes moisture content, total ash, acid insoluble ash, water-soluble ash, water-soluble extractive and alcohol soluble extractive ^[3]. The values for physicochemical parameter are tabulated in (Table 3).

Table 3: Physicochemical constant

Sample identity	% LOD	% Total ash	Acid insoluble ash %	Water soluble ash %	Water soluble Extractive value %	Alcohol soluble Extractive value %
leaves	13	11.8	3.05	2.14	28.16	07.17

Chemical profile

The proximate profile included moisture (90.05±0.00%), total carbohydrate (5.10±0.02% WW and 51.26±0.20% DW), crude protein (3.44±0.00% WW and 34.57±0.00% DW), crude fat (0.60±0.02% WW and 6.03±0.20%), crude fibre (0.61±0.04% WW and 6.13±0.40% DW) and a total ash content of 0.20±0.02% WW and 2.01±0.20% DW enriched with calcium (2.09 mg/100 g WW and 20.96 mg/100 g DW), sodium (5.02 mg/100 g WW and 50.44 mg/100 g DW) and potassium (3.18 mg/100 g WW and 31.92 mg/100 g DW). The Phytochemical investigation disclosed the presence of flavonoids (catechins and flavones), alkaloids, carotenoids, tannins and saponins. This result suggests the chance of this plant serving as a potential source of protein supplements and provitamin A (carotenoids) ^[4]. Many other chemical constituents like n-hexane, fumaric acid, β-sitosterol, luteolin, quercetin, oxoester, myristic, palmitic, lauric acid, arachidic, and linoleic acid etc are also reported. Some sterols were also identified by GC-MS and reported. A new flavonoid “Procumbenetin” was isolated from aerial parts of *Tridax procumbens* and has been characterized as 3, 6- dimethoxy-5, 7, 2', 3', 4'- pentahydroxyflavone 7- O-β-glucopyranoside⁵. Earlier researchers have reported the

presence of luteolin, glucoluteolin, dexamethasone, betasitosterol and quercetin ^[6, 7]. The Report also showed the presence of linolenic acid in the aerial parts. Two water-soluble polysaccharide, WSTP-IA and WSTP-IB containing β- (1->6)-DGalactan main chain has also been isolated from the leaves of the plant ^[8].

Table 4: Qualitative Profile of Phytochemicals Found in *Tridax procumbens* Leaves

Phytochemicals	Status
Alkaloids	+
Carotenoids	++
Flavonoids	
Catechin	+
Flavones	+
Saponins	+
Tannins	++

Key: + = moderately present; ++ = highly present

Traditional uses

Tridax procumbens has been extensively utilized in the Ayurvedic system of medication and is well-accepted medicine for a liver disorder. It's been found to possess significant medicinal properties against malaria, dysentery,

diarrhoea, bronchial catarrh, blood pressure, hair fall, stomach ache, headache and hair fall. It also has wound healing properties and check hemorrhage from cuts and bruises. Antiseptic, insecticidal and parasitocidal properties were reported in flowers and leaves. The plant also possesses immunomodulatory, antidiabetic, antihepatotoxic and anti-oxidant, anti-inflammatory, analgesic activity^[9-11].

Pharmacological review

Antibacterial activity

A study on antibacterial activity by (Kumar *et al.*, 2014) on whole plant and individual parts of *Tridax procumbens* against *Escherichia coli*, Klebsiella, pneumoniae and *Proteus vulgaris* (Gram-negative), *Bacillus subtilis* and *Staphylococcus aureus* (Gram-positive) by agar well diffusion method using ethanolic and methanolic extracts displayed broad-spectrum activity against all the test organisms.

The results from the above study stated that there was poor or no activity from the chloroform and Petroleum ether extracts of the roots against Gram-negative bacteria.

The minimum inhibitory concentration (MIC) of both ethanolic and methanolic extracts of leaf and whole plant ranged between 1.96-19.5 and 1.96 with that of *Staphylococcus aureus* being the least. It supports its antibacterial activity^[12].

Anti-cancer activity

Aqueous and acetone flower extract of the traditional plant *Tridax procumbens* were tested on Prostate Epithelial Cancerous Cells PC-3, determined by measuring cell viability by MTT assay. The inference of the experiments was the cleavage of the soluble yellow coloured tetrazolium salt MTT [3-(4, 5-dimethyl – thiazole-2-yl)-2, 5-diphenyl tetrazolium bromide] to a blue coloured formazan by the mitochondrial succinate dehydrogenase. The assay relies on the capability of mitochondrial enzymes of viable cells to reduce the yellow soluble salt MTT to purple-blue insoluble formazan precipitate which is then quantified spectrophotometrically at 570nm.

The results of these studies showed that the flower crude extract of the plant *Tridax procumbens* possesses vital anti-cancer activity^[13].

Anti diabetic activity

The hypoglycemic activity of dried aqueous, alcoholic, and petroleum ether (60-80 °C) extracts of leaves of *Tridax procumbens* was investigated by Durgacharan A *et al.* Experimental studies reveal that the aqueous and alcoholic extracts from *Tridax procumbens* leaves (200 mg/kg) orally administered for 7 days produced a significant reduction in the blood glucose level in alloxan-induced diabetic rat's model. Petroleum extract exhibits a very weak anti-diabetic activity^[14].

Hepatoprotective activity

Jude *et al.*, 2009, screened the potential of an aqueous extract of the leaves of *Tridax procumbens* to protect against carbon tetrachloride-induced liver injury in Wistar albino rats. The carbon tetrachloride was prepared in olive oil and administered subcutaneously at 1 ml/kg body weight. The extract was administered to normal and carbon tetrachloride treated rats at 100, 200, and 300 mg/kg. Treatment dose-dependently significantly lowered ($p < 0.05$) alkaline

phosphatase (54.91-100.52%), aspartate transaminase (37.74- 64.79%), and alanine transaminase (32.96-57.82%) activities as compared to test control. The plasma total bilirubin and total protein levels of the treated animals were lower although not considered significant. The results of this study indicated that treatment with the plant extracts protects the liver against carbon tetrachloride-induced hepatotoxicity; therefore the study suggests the use of *T. procumbens* in African tradition for the treatment of liver problems.

Anti-fungal activity

This study was designed to evaluate the antifungal potential of alkaloids and flavonoids of different parts (root, stem, leaf and flower) of *Tridax procumbens* L against two pathogenic fungal strains (*Aspergillus flavus* and *Aspergillus niger*) by disc diffusion assay method. Antifungal activity was screened by evaluating Minimum inhibitory concentrations (MIC), minimum fungicidal concentrations (MFC) and total activity of each active extracts.

As per the study, the flavonoid extracts showed markedly significant activity against *A. niger* whereas alkaloid extracts were found inactive against both the test fungi. Significant antifungal potential was shown for free flavonoid of stem (IZ 12 mm, AI 1.2, with same MIC and MFC 0.156 mg/ml), bound flavonoid of stem (IZ 10 mm, AI 1, MIC 0.312 and MFC 0.625 mg/ml) and flower (IZ 10.2 mm, AI 1.02, with same MIC and MFC 0.312 mg/ml) against *A. niger*. These results indicated that the plant *T. procumbens* possesses antifungal activity.

Antimicrobial activity

This study was conducted to assess the antimicrobial potential of free and bound flavanoid extracts of pedicle and buds of *Tridax procumbens* Linn against three bacteria (*Escherichia coli*, *Staphylococcus aureus* and *Proteus mirabilis*) and four fungi (*Aspergillus flavus*, *Aspergillus niger*, *Candida albicans* and *Trichophyton mentagrophytes*) by disc diffusion assay method. Minimum inhibitory concentrations, minimum bactericidal/fungicidal concentrations were screened for determination of the antimicrobial potential of the extracts.

The flavonoid extracts showed significant antimicrobial activity against all the test pathogens except *A. flavus* against which none of the test extracts showed activity. It is observed that free flavonoids from pedicle (active against 5 out of 7 test pathogens) and bound flavonoid from bud (active against 4 out of 7 pathogens) exhibited significant antimicrobial activity. It is also found that *S. aureus* was the foremost susceptible microorganism that was sensitive towards all extracts. This result shows the antimicrobial activity of the free and bound flavonoid extracts of pedicle and buds of *Tridax procumbens*.

Immunomodulatory Activity:

Immunomodulatory activity of an ethanol-insoluble fraction of aqueous extract of *Tridax procumbens* was reported in this study. In this Study, Swiss albino rats were treated with *Pseudomonas aeruginosa*. Rats were divided into six groups of four per group. The first group was treated with the standard inoculum of *Pseudomonas aeruginosa* only and the second group was given 8 mL of the standard inoculum of the organism and treated with ethanolic extract of *Tridax*

procumbens. The third category was treated with the ethanolic extract of *Tridax procumbens* only, whereas normal saline was administered to the last group. From the results, it was noticed that the phagocytic index, leukocyte count and splenic antibody secreting cells increases significantly. The immunomodulatory potential of ethanolic extracts of leaves of *Tridax procumbens* was also evaluated against *Pseudomonas aeruginosa* induced albino rats and was found that the extracts have the ability to inhibit the proliferation of *Pseudomonas aeruginosa*.

Anti-ulcer activity

The antiulcer activity of methanolic extracts of *Tridax procumbens* was screened by Aslam Pathan *et al.* During this study albino rats were treated with methanol extract 100 mg/kg of *Tridax procumbens* Linn and ulcer protection activity using myeloperoxidase activity was evaluated. The results revealed that the myeloperoxidase activity of methanol extract 100 mg/kg (2.74 U/g) is lower than experimental control (4.74 U/g). From this study, it can be concluded that the methanolic extract (100 mg/kg) of the whole plant of *Tridax procumbens* Linn possesses ulcer prevention and protection activity and should be helpful for the hindrance of ulcerative colitis.

Wound healing activity

Yaduvanshi *et al.*, 2011 investigated the wound healing activity of topical ointment formulation of the leaf juice of *Tridax procumbens* using excision wound model in mice. Excision wounds (4 mm, i.d.) were inflicted on depilated back of mice. Ointment formulation of *Tridax procumbens* (50 mg of either 1 or 4 mg/g) was applied twice daily for 4 days on the dermal wound. Control group was treated with VEGF ointment (50 mg of 1 µg/g). Various parameters like re-epithelization, vascularity, fibroblast number, collagen content were observed. The healing potential of *Tridax procumbens* (1 mg/g) was compared with the control group. The results of this investigation revealed that *Tridax procumbens* possesses dose-dependent pro-healing potential, and its high dose exerts an inflammatory reaction.

Anti-arthritis activity

This study was conducted to assess the anti-arthritis activity of whole plant ethanolic extract of *Tridax procumbens* using Freund's Complete Adjuvant (FCA) model. Here arthritis was induced using FCA, and the anti-arthritis effect of the ethanolic extract of *Tridax procumbens* was evaluated at doses of 250 and 500 mg/kg and the effects were compared with indomethacin (10 mg/kg). At the end of the investigation, the liver enzyme levels were determined and a radiological examination was carried out. The study implies that *Tridax procumbens* at a dose of 250 and 500 mg/kg significantly inhibited FCA-induced arthritis in the rats 24. The results of this investigation suggest that the vasorelaxant effect of *Tridax procumbens* leaf extract may be due to non-specific, non-competitive inhibition of Ca²⁺ influx as well as by inhibition of Ca²⁺ mobilization from intracellular stores. This implies that the extract may have vasorelaxant agents that may have calcium antagonistic activity.

Antidiarrhoeal Activity

The phytochemical profile and antidiarrhoeal activity of aqueous and ethanolic leave extract of *Tridax procumbens*

were performed in this study. Phytochemical investigations of aqueous and ethanol extract of *Tridax procumbens* leaves showed the presence of twelve bioactive compounds which are the alkaloid, tannin, saponin, flavonoid, phenol, cardiac glycoside, phytosterol, steroid, phlobatannin and triterpenoid. Antidiarrhoeal activity was carried out on gastrointestinal motility and castor oil induced diarrhoea in Wistar rats. Both aqueous and ethanol leave extracts of *Tridax procumbens* showed markedly significant antidiarrhoeal activity on gastrointestinal motility with barium sulfate milk model, whereas the aqueous extract showed no significant reduction in castor oil-induced diarrheal model when compared with Lomotil drug (standard group). This result implies that the leaf extract of *Tridax procumbens* might possess antidiarrheal activity and this supports the use of the plant in traditional medicine.

Conclusion

The present review revealed that the plant *Tridax procumbens*, Possesses varied pharmacological properties. The phytoconstituents present in them are responsible for the biological activities. The diversity of phytochemicals present in this plant provides drug lead for the development of novel therapeutic agents.

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