

Bioactive Potentials of *Tridax procumbens*

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Abstract—Increase in drug resistance has forced society to opt to traditional system of medicine. Presently lot of herbal products are in market which are being used for not only mild diseases but also for dread diseases like cancers. *Tridax procumbens* is one such plant that is reported to possess wide range of bioactive potential like wound healing, anti-diabetic activity, anti-arthritic activity, preventing hair loss, diarrhoea etc. Almost all parts of plant like leaves, flowers, stem, seeds, are useful for controlling inflammatory conditions. Nano formulations of *Tridax procumbens* has been commercialized for treating variety of diseases. The present review highlights use of *Tridax procumbens* from ancient to modern times.

Keywords— *Tridax procumbens*, bioactive potential, antiinflammatory, antidiabetic, anticancer, antimicrobial.

I. INTRODUCTION

Forest cover 30 percentage of earth's area and are one of the biggest sources of natural drugs since they contain useful metabolites. *Tridax procumbens* Linn belongs to the family of Asteraceae (1). *Tridax procumbens* also known as Indian Ghamra, or button shirt in English, is a native American reptile. In India it is found as a wild herb. It can be easily available on a road side, waste grounds, rail tracks, dikes, river banks and meadows (2). Plant is rich in red fat-soluble pigments, including carotene. *Tridax procumbens* is found to grow in every season. The leaves and flower are claimed to be very useful in the treatment of inflammatory conditions and it is probably used to heal wound, anti-diabetic, anti-arthritic, preventing hair loss, diarrhea etc. *Tridax procumbens* contains high quantity of minerals such as sodium, calcium and potassium (3). It has immense antibacterial and antifungal potential, demonstrating various activities, primarily including antimicrobial effects. (4). Bioactive potentials of *T. procumbens* finds its applications in a Ayurvedic system of medicine for wound healing, treating jaundice, antifungal, anticoagulant activities (5). Its extracts have also been used to prevent hair fall, bronchial catarrh, dysentery, malaria, diarrhea and high blood pressure. Its leaf juice has attracted pharmaceutical industry widely because of its antiseptic, insecticidal, and parasiticidal properties (6). The extract of the plant has been noted to have a depressant effect on respiration.

II. DISTRIBUTION, ANATOMY AND BIOACTIVE POTENTIALS OF *TRIDAX PROCUMBENS*

Distribution

Tridax procumbens, coat buttons originated in Central America and are presently found in all tropical and subtropical areas of the world. Generally, they can be isolated with the *Tridax procumbens* and is found in almost every habitat like agricultural fields, dry and arid soils, near railway tracks, along roadside, river banks, near sewage tanks etc. It was introduced in Nigeria as an ornamental plant but later it spread over all the tropical areas it can be classified as a noxious weed in a

north and south, Florida and Minnesota, California and Vermont (7)

Biochemical Composition of *Tridax Procumbens*

Screening of phytochemicals revealed presence of flavonoids, tannins, alkaloids, carotenoids and saponins. The results of previous studies have reported *T. procumbens* have high content of sodium, potassium and calcium (8). The extract of *Tridax* leaf comprised of crude proteins 26%(w/v), crude fiber 17%(w/v), soluble carbohydrates 39%(w/v), calcium oxide 5%(w/v). While, extract of flower contained luteolin, glucoluteolin, quercetin and Isoquercitrin. It also contains large quantities of fumaric acid and β -sitosterol (9). Aqueous and methanolic leaf extract of *Tridax procumbens* also contained Phlobatannins, terpenoids, cardiac glycosides, anthraquinones, anthracene derivatives of Rhein, Emodol, aloe-emodin, sennosides A and B, 4, 5-dihydroxy-1-hydroxymethylanthrone, 4,5-dihydroxy-2-hydroxy-methyla are also reported to be present in *Tridax* sp. (10). Reddy and his coworker observed and reported the presence of dexamethasone, luteolin, glucoluteolin, β -sitosterol, quercetin, flavones, glycosides, polysaccharides and monosaccharides on leaf extract (11).

Propagation of *Tridax Procumbens*

General plant propagates through dispersal of seeds. Due to urbanization the open soil area has reduced which have reduced density of weed plants. *Tridax procumbens* has experienced a decline in its distribution in past few years. Vegetative propagation methods, such as cuttings and tissue culture have attracted attention for propagating *T. procumbens*. Consequently, recent advancements in *ex-situ* conservation through micropropagation have been developed (12). These advanced biotechnological techniques for growing plants and tissues are new tools for the conservation of rare and endangered medicinal plants (13).

Anatomical and Morphological Features of *Tridax Procumbens*

Number of medicines derived from medicinal plants has increased, with these plants serving over 80% of health needs

(14). Many medicinal plants have been evaluated for their antibacterial potential and various biological activities (15). Plants are identified based on their morphological and anatomical characteristic. The leaves of *Tridax procumbens* are elongated, opposite, and ovate with serrated margins and are hirsute on both sides (16). The inflorescence is a capitulum with three-toothed white ligulate ray florets (female) and yellow tubular bisexual disc florets with a corolla 6 mm long. This inflorescence results in an abundant production of pappus achenes, which are 2 mm long, obovoid, setaceous, and covered with stiff hairs. These achenes can be carried by the wind over long distances, making the species potentially invasive if not controlled (17).

Antimicrobial activity:

The methanolic and ethyl acetate extract of *Tridax procumbens* was tested against various bacterial species using the disc diffusion and agar well diffusion methods. *Tridax procumbens* inhibited microorganisms related to nosocomial infections. The methanolic extract was found to be less effective than the ethyl acetate extract. *Staphylococcus aureus*, *Salmonella typhi* and *Bacillus cereus* species showed greater zone of inhibition using ethyl acetate extract whereas with methanolic extract, only *Escherichia coli* have shown significant zone of inhibition (18). Similarly, inhibitory effect of methanolic extract of *Tridax procumbens* studied using agar gel diffusion method have shown antimicrobial activity against *Staphylococcus aureus*, *Klebsiella pneumonia*, *Salmonella typhi* and *Escherichia coli* while with ethyl acetate extract *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Salmonella typhi*, *Escherichia coli* and *Bacillus cereus* were significantly inhibited (19). The ethanolic extract of leaf of *Tridax procumbens* exerted antibacterial activity against *Pseudomonas vulgaris*. Ethanolic extract has also shown antibacterial activity against Gram negative non-fermenting multidrug resistant *Pseudomonas* isolated from the nosocomial infection. The antibacterial infection may be due to the presence of flavonoids and tannins which are known to inhibit energy generation pathways and cytoplasmic membrane functions (20,21). Bioactivity of herbal extract may be attributed to the presence of flavonoids and tannins, which can inhibit energy metabolism, disrupt cytoplasmic membrane functions, and affect other microbial processes (22). Attempts have been made to purify phytochemicals of *Tridax procumbens* using solvent fractionation and column chromatography (23). Its herbal bioactive potentials have been reported in traditional system of medicine of Asia, Chinese and African (24). Secondary metabolites of plants such as flavonoids are active against pathogenic organisms (25). Antibacterial agents derived from plants have various therapeutic properties with a little or no side effects (26). *Tridax* stem has been found to contain antimicrobial compounds (27, 28). Antibacterial assay of *Tridax procumbens* against *Escherichia coli*, *Proteus mirabilis*, *Staphylococcus aureus*, and *Bacillus subtilis*, was studied by growing culture in Luria-Bertani (LB) broth medium, the results were quantified after 24 hours at 37°C (29).

Antifungal activity: The antifungal activity of *Tridax procumbens* is cause due to the presence of phenols, flavonoids, fatty acids, sterols or many bioactive compounds. The essential oil is mainly obtained from flower of the *Tridax procumbens* and it was found to be active against the fungi. The zone of inhibition ranging from 17 to 25mm against various fungal strains by methanol extract fractionated with dichloromethane which include *Microsporum fulvum*, *Microsporum gypsum* and *Candida albicans* (30). Inhibition of *A. niger* was caused by *Tridax procumbens*, the study suggested it can be used to treat fungal diseases (31). *Tridax procumbens* have shown inhibition of three phytopathogenic fungi that is *Helminthophobia oryzae*, *Rhizoctonia Solani* and *Pyricularia oryzae*. The flowers have the excellent inhibitory potential against the tested plant pathogens, *Fusarium oxysporum*. Free flavonoids and sterols of *T. procumbens* (flower) completely inhibited the spore formation by fungi (32).

Anti-diabetic activity: Antidiabetic activity of the methanolic extract of *Tridax procumbens* is exerted due to presence of Quercetin. The aqueous and alcoholic extracts from the *Tridax procumbens* leaf extract produced a decrease in the blood glucose level in the alloxan induced diabetic rat model (33). Studies have shown that the presence of flavonoids in plant extracts regenerates damaged pancreatic beta cells and polyphenolic compounds, while saponin inhibits glucose transport by blocking glucose transport. by sodium-glucose-1 (S-GLUT-1) in the intestine (34). Dihydroxyolide an active principle of hexane extract exhibited, antidiabetic effect, it also reduces glucose absorption and inhibit the postprandial rise in blood glucose levels in type-II diabetes. The methanol extract of *Tridax procumbens* has better results than the standard drug Glibenclamide. The plant extract improves the fasting blood glucose levels of an alloxan induced diabetics rats (35)

Anti-Inflammatory Activity: Ethyl acetate fraction of *Tridax procumbens* is the most active fraction and was found to contain a moderate polar natural products like alkaloids and flavonoids. Both alkaloids and flavonoids can counteract reactive oxidative species it involved in the pathogenesis of inflammation and ailments in biological systems. Leaves of *Tridax procumbens* were tested for their contractile activity in response to the potent gastrointestinal constrictors (36) The presence of flavonoids and sterol indicates that the extract of *Tridax procumbens* may be used as an effective analgesic, it can also be used as anti-diarrhea and as anti-dysentery (37). Its extract was found to stabilize RBC and thus is effective as anti-inflammatory agent (38). Acetyl derivatives of isolated phytosterols have shown highly significant anti-inflammatory activity in rats (39,40).

Wound healing activity: The interaction between epidermal and dermal cells is complex and plays a critical role in wound healing. The extracellular matrix regulates angiogenesis and plasma-derived factors, all of which are coordinated by a range of cytokines and growth factors (41). *Tridax procumbens* is associated with anti-epithelialization and potentiation by reducing the effect of known anti-inflammatory drugs such as dexamethasone, without

interfering with its anti-shrinkage and anti-granulation (42). The *Tridax* plant increases protein, lysyl oxidase and nucleic acid levels in the granulated tissue, which likely results from an increase in glycosaminoglycan content (43). Similar kind of wound healing activity was obtained in albino rat with the aqueous extract (44). Ethanolic extract of *Tridax procumbens* was more effective in wound contraction and wound healing activity as compared to the aqueous extract. The application of extract on wound increased granulation and hexosamine. A significant increase in the hydroxyproline content of granulated tissue was also noticed. Wound healing property of silver nanoparticles of *Tridax procumbens* was studied on fish have shown significant healing capacity in *Tridax extract* (45) The ethanolic extract of *Tridax procumbens* has a great impact on wound healing in diabetic and non-diabetic rat (46). The extract has shown burn wound, excision, incision and they have created EETP ointment to test the potential for healing wounds. The treatment shows the significant contraction of a wound and wound index. The *Tridax procumbens* shows a great effectiveness as ointment. The ointment prepared was applied for twice a day for 15 days (47). Ayurvedic dosage forms ash, Kalka, oil, Ghana, of *Tridax procumbens* were found to be less effective as compared to ethanol extract (48).

Anti-Cancer activity:

Tridax procumbens essential oils demonstrated anti-metastatic activity in a lung cancer development, the studies were carried out in mouse model changes in body weight, hemoglobin count, and white blood cell count were monitored. The active components identified, including α -pinene, β -pinene, phellandrene, and sabinene, belong to the monoterpene family (49). In addition, *Tridax procumbens* flower extract was tested on prostate epithelial cancer cells using the MTT method. The extract showed anti-cancer activity.

Other curative effects of *Tridax procumbens*:

Various parts of *Tridax procumbens* have been used in India to treat conditions such as hypertension, bronchial catarrh, malaria, digestive issues, wound healing, conjunctivitis, dysentery, inflammatory conditions, as well as to prevent hair loss and control hemorrhage from cuts (50).

Nano-Herbal formulation:

Nanosized materials exhibit different physicochemical characteristics compared to their bulk or larger counterparts. These differences are primarily attributed to their high surface area-to-volume ratio, surface plasmon resonance, enhanced chemical reactivity, high catalytic activity, lower melting points, (51) and exceptional mechanical strength. The reduction of metal ions in solution or the aggregation of molecules is used for the synthesis of nanoparticles. Various methods are employed for this reduction, including chemical and physical methods. However, adverse effects such as toxic waste and high energy consumption are associated with these methods. In contrast, biogenic methods are more eco-friendly. Chemical and physical methods offer alternatives to green synthesis, which involves biological agents such as fungi, bacteria, plants, and algae. These biological methods are not only economically viable but also environmentally friendly (52). Plant extracts, in particular, are gaining interest as

effective reducing and capping agents. They often provide faster results compared to microorganisms like bacteria and fungi. The rapid growth and advantages of plant extracts in green synthesis have attracted considerable attention. This approach offers a single-step, economical protocol that is both non-pathogenic and eco-friendly for nanoparticle synthesis (53).

Bioactive Potentials of *Tridax Procumbens* Phytoconstituents:

	Phytochemical constituent	Bioactivity
<i>Tridax procumbens</i>	Aloe-emodin	Antimicrobial, Anti-inflammatory, Antioxidant activity
	Flavonoids	Antimicrobial, Anti-inflammatory, Antioxidant activity, Anticancerous activity
	Overcistins	Antibacterial, Antimicrobial, Antifungal, Wound healing activity
	Tannins	Antimicrobial, Anti-inflammatory, Antioxidant activity
	Alkaloids	Antimicrobial, Anti-inflammatory, Antioxidant activity
	Carotenoids	Anti-inflammatory, Anticancerous, Antioxidant activity
	Saponins	Antimicrobial, Anti-inflammatory, Antioxidant activity
	Luteolin	Antimicrobial, Anti-inflammatory, Antioxidant activity, Anticancerous activity
	Glucoluteolin	Antimicrobial, Anti-inflammatory, Antioxidant activity, Anticancerous activity
	Isoquercitrin	Antimicrobial, Anti-inflammatory, Antioxidant activity, Anticancerous activity
	Fi-sitosterol	Antimicrobial, Anti-inflammatory, Antioxidant activity
	Phlobatannins	Antimicrobial, Anti-inflammatory, Antioxidant activity, Antidiabetic
	Terpenoids	Antimicrobial, Anti-inflammatory, Antioxidant activity, Anticancerous activity
	Carantraquinones	Antimicrobial, Anti-inflammatory, Antioxidant activity
	Anthracene	Antimicrobial, Anti-inflammatory, Antioxidant activity
Rheinenodol	Antimicrobial, Anti-inflammatory, Antioxidant activity	

III. CONCLUSIONS

Tridax procumbens contains multiple bioactive compounds which are of wide biomedical applications. The aqueous methanolic ethanolic ethyl acetate extract of leaf stem and flowers are reported to produce antibacterial, antifungal, anti-inflammatory, Anticancerous and antidiabetic compounds.

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