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A REVIEW OF: *TRIDAX PROCUMBENS*: MEDICINAL USES AND PHARMACOLOGICAL ACTIVITY, PHYTOCHEMICAL SCREENING.

Rafiq Pinjari[1]*, Shraddha Vaishnav[1]*, Dr. Gangurde Avinash B., Prashant Shevale, Sonawane Khyati, Dr. Vinod Bairagi

Department of Pharmaceutics, K.B.H.S.S.Trust's Institute of Pharmacy, Nashik, India.

ABSTRACT: *Tridax procumbens* Linn belongs to the family Asteraceae. The various extracts of *Tridax procumbens* have been used as indigenous medicine for a variety of diseases and disorders in human beings as well as animals. It has been extensively used in Indian traditional medicine for wound healing, as anticoagulant, in fungal infection, in diarrhea and dysentery, as antioxidant, antimicrobial, anti-inflammatory and immunomodulatory. Leaf extracts are used to treat infectious skin diseases in folk medicines. It is also dispensed as 'Bhringraj' which is well known ayurvedic medicine for liver disorders. Plants contain phenols or their oxygen substituted derivatives which are mostly secondary metabolites. At least 12,000 have been isolated. These substances serve as plant defense mechanisms against predation by microbes, insects, herbivores. It also contains terpenoides and flavoring agents etc.

INTRODUCTION

Tridax procumbens Linn also referred to as "Ghamra" or "coat buttons," is used in Ayurvedic medicine to treat liver diseases. The plant was first discovered in tropical America and has since expanded to tropical Africa, Asia, Australia, and India. India has a long history of using several systems-based traditional medicines, such as Ayurveda, Siddha, and Unani. The plant is a useful addition to Indian medicine because of its flower-like appearance and therapeutic qualities.(1)

A medicinal plant known for its anti-oxidant, anti-hepatotoxic, analgesic, antidiabetic, anti-inflammatory, antifungal, and antibacterial qualities is *T. procumbens*. Its defense mechanisms and secondary metabolites, which include flavonoids, alkaloids, tannins, carotenoids, and saponins, are what give it its flexibility. The significance of this species in the production of therapeutic herbs is emphasized in this review, as is the necessity of merging traditional and scientific knowledge in further studies.(2)

PLANT PROFILE

Tridax procumbens

- **Scientific Classification of *Tridax procumbens*:**

  Kingdom: Plantae

  Division: Spermatophyta

  Subdivision: Angiospermae

Class: Dicotyledonae

Subclass: Cotyloideae

Order: Asterales

Family: Asteraceae

Common Name: Coat buttons

Botanical Name: *Tridax procumbens* Linn

- **Synonyms:** Coat buttons, Gaddi Chemanthi, Ghajadvu, Mexican daisy, Tridax daisy, and Tridhara.[3]

Figure 01: The Plant of *Tridax procumbens Linn.*

- **Geographical source**:
  Originating in the tropical Americas, *Tridax procumbens* has spread around the world to tropical and semitropical areas as well as temperate ones. It has blighter standing and is considered a noxious plant in nine states.

- **Morphological Characters:**
  Tridax procumbens is a perennial plant with opposing, pinnate, rectangular to oblong leaves and a creeping stalk. It has white rays and yellow disk flowers that bloom in the spring. The plant has a regenerated stem that is 40.6 inches wide and 4-12 inches long. Fruits have an adjustable head of calyx bristles and are rectangular, dark brown to black in color. *Tridax procumbens* is a tropical native that is included on the Federal Pernicious Weed List. It spreads to roadsides, waste land, fallow land, and crops. Though it originated in South America and Mexico, it is now a global invasive weed.[4]

- **Parts of Herb's:**

Figure 02: The Leaf of *Tridax procumbens Linn*.

1. **Leaves:**

Because of its antibacterial, antipyretic, and anti-inflammatory qualities, *Tridax procumbens* leaves are frequently employed in traditional herbal medicines. They can be applied as a poultice to treat skin disorders and promote wound healing.

Figure 03: The Root of *Tridax procumbens* Linn.

2. **Roots:**

Though less prevalent than leaves and flowers, *Tridax procumbens* roots are said to have therapeutic qualities and can be utilized in a variety of traditional herbal medicines.

Figure04: The Flowers of *Tridax procumbens Linn.*

3. Flowers:

The antibacterial qualities of *Tridax procumbens* flowers are used in traditional medicine, where they are thought to be helpful for a range of medical conditions.

- **Microscopic study:**
  The single-layered structure of Tridax procumbens leaves is made up of spongy parenchyma, cylindrical palisade cells, and polygonal tabular cells. The cortex is made up of oblong to polygonal parenchymatous cells, whereas the roots feature tangentially elongated cells with thin walls. A single layer of pericycle, composed of alternating phloem and xylem arranged in a circular pattern envelops the stele. The cortex of the stem slice is composed of 1-2 layers of collenchyma and 6-7 layers of parenchyma. Under powder microscopy, fibers, collenchyma cells, glandular trichomes, latex cells, and root cortex cells may be seen, yet the endodermis is not exact. Spiral vessels and unicellular covering trichomes are features of the leaf. Although it is not exact, the endodermis can be seen with powder microscopy.[5]

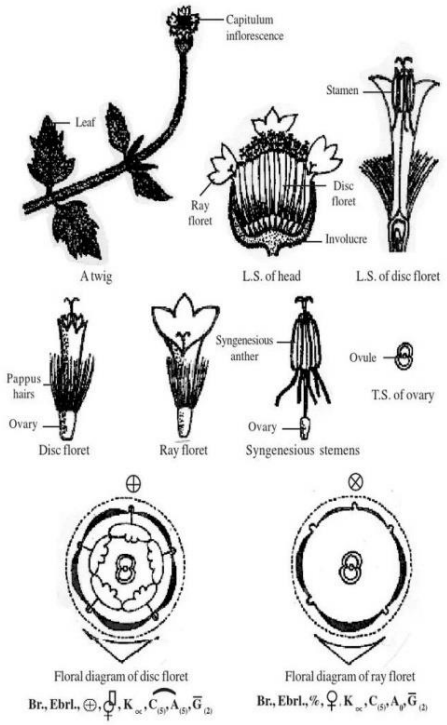

Figure No 05: Microscopic study for *T. procumbens*

- **Extraction Procedure:**
  The study extracts juice from air-dried plants, powdered dry leaves, and fresh leaves using a soxhlet extractor. The yield at room temperature is found to be 6% W/V. Methanol and methylene chloride are used to make standard solutions for tannins, phytosterols, and alkaloids. The concentration-dependent reliance of the reaction is confirmed to be linear using regression analysis. The Tram technique, oil extraction using AOAC method 999.02, and sterol analysis using AOAC method 994.10 are examples of common extraction techniques. The separation and measurement of sterol derivatives are accomplished via non-saponifiables, extract cleaning, sterol derivatization, and gas chromatography. [6]

- **Medicinal uses:**
  Native to India, Nepal, and Nigeria, T. procumbens is a wild plant that is used to treat a variety of illnesses such as diarrhea, bronchial catarrh, dysentery, and inflammation. Additionally, it is recommended as "Bhringraj" in Ayurveda to heal liver disorders and encourage the development of hair. T. procumbens leaves have insecticidal and parasitic properties, and they are used to halt bleeding from wounds, bruises, and cuts. Fresh leaf juice from the plant has been used for generations in traditional medicine to treat wounds, skin ailments, typhoid fever, coughing, and blood clotting. It is used to treat tonsils, tonsillitis, oral ulcerations, diarrhea, and gastrointestinal diseases in Guatemala.T. procumbens is a wild plant native to India, Nepal, and Nigeria that is used to cure a wide range of ailments, including inflammation, bronchial catarrh, diarrhea, and dysentery. Furthermore, in Ayurveda, it is advised as "Bhringraj" to treat liver conditions and promote the growth of hair. The leaves of T. procumbens are used to stop bleeding from cuts, bruises, and wounds because they contain parasitic and insecticidal qualities. For millennia, traditional medicine has employed fresh leaf juice from the plant to treat typhoid fever, wounds, skin conditions, coughing, and blood clotting. In Guatemala, it is used to treat gastrointestinal disorders, mouth ulcers, tonsils, and tonsillitis.[7]

- **Chemical Constituents:**
  Alkaloids, flavanoids, cartenoids, fumaric acid, luteolin, quercitin, oxyester, lauric acid, myristic, palmitic, arachidic, linoelic acid, and tannin are some of the chemical components found in Tridax procumbens. It has been recognized as a possible source of supplements including potassium, plant protein, and provitamin A. Minerals including calcium, magnesium, potassium, sodium, and selenium are also present in the plant. In addition to bis-bithiphene, the plant also yields four other terpenoids: beta-amyrenone, lupeol, and oleonic acid. Two new flavones, betulinic acid, oleolic acid, esculetin, and puerarin were extracted from Tridax procumbens Linn. Additionally, the plant is known to contain four substances: esculetin, puerarin, oleolic acid, and betulinic acid.[8]

PHARMACOLOGICAL ACTIVITY:

Anti-microbial activity:
Asteraceae is the family that includes the green perennial plant Tridax procumbens Linn, which grows in India. Arachidic acid, lauric acid, palmatic acid, flavones, and glycosides are among the compounds it creates. There have been reports of a variety of pharmacological effects and antibacterial activity of Tridax procumbens extracts against gram positive and gram negative pathogens. These results demonstrate the plant's potential for therapeutic use.(9)

Wound Healing activity:
A succession of biological activities takes place during the healing process of wounds with the goal of rearranging the wounded tissue and reestablishing its normal continuity. Living things respond to wounds that heal rapidly in order to stay healthy.(10)

Antifungal activity:
On Sabouraud Dextrose Agar medium, two fungal strains—Aspergillus niger MTCC 282 and Aspergillus flavus MTCC 277—were cultured. Disc diffusion test 11 was used to assess the antibacterial activity of the extracts with a standard drug concentration of 1 mg/disc of itraconazole. To assess the antifungal activity of three different extracts, the Zone of Inhibition (IZ) was evaluated. Each extract's Activity Index (AI) was calculated by dividing its IZ by the IZ of the standard. (11)

Anti-daibetic activity:
In an animal model, the study discovered that alcoholic leaf decoctions and water dramatically lowered blood glucose levels. Oral administration of 50% methanol decoctions dramatically reduces fasting blood glucose levels in diabetic rats. Animals were given 200 mg/kg body weight of the plant extracts—which are often used in herbal medicines—orally for seven days. Blood glucose levels were dramatically reduced by the alcohol and water decoctions, but only slightly by the petroleum ether extract.(12)

Anti-inflammatory activity:
To maintain steady paw volume, the study required weighing, numbering, and marking the hind paws just beyond the tibio-tarsal junction. Each rat's initial paw volume was recorded using the mercury displacement method, and the outcomes were compared and scrutinized.

Anti-bacterial activity:
Animals were weighed, numbered, and their hind paws were marked just beyond the tibio-tarsal junction to guarantee consistent paw volume for the research. The beginning paw volume of each rat was measured using the mercury displacement method, and the findings were compared and analyzed. (13)

Hepatoprotective activity:
The capacity of *Tridax procumbens* aerial parts to shield rats from d-galactosamine/lipolysaccharide (d-GalN/LPS), a hepatotoxic substance that can kill liver cells,-induced hepatitis was investigated in this work. Multifocal necrosis brought on by d-GalN and the lesion of viral hepatitis in humans is comparable. Within eight hours of consumption, the amino sugar causes fulminant hepatitis.(14)

Immunomodulatory:
Ethanolic extracts from Tridax leaves have been shown to have immunomodulatory effects on albino rats, which inhibit Pseudomonas aeruginosa development. The humoral immune response was stimulated by the ethanol insoluble fraction of Tridax extract, which also markedly enhanced leukocyte count, phagocytic index, and splenic antibody-secreting cells.(15)

Anti-oxidant Activity:
Using DPPH, the study measured the free radical scavenging capacity of ascorbic acid and Tridax procumbens fractions. The antioxidant activity of the methanol extract fractions is expressed by the IC50, or the concentration of the fractions showing a 50% decrease in DPPH radical generation.

Anti-cancer Activity:
The MTT test was used to determine the cytotoxicity of chemicals obtained from plants against human lung cancer cells. One material that was shown to have a 90% reduction in cell viability was lupeol. Its anti-cancer properties were assessed by the study using a range of techniques, such as DNA fragmentation, cell

cycle regulation, clonogenic survival assessment, and COX-2 activity inhibition. At 320 µg/ml, the luteol molecule demonstrated notable anti-tumor effectiveness.[16]

Anti-malarial Activity:
The water and ethanol infusions exhibit little toxicity to human red blood cells and possess anti-plasmodial qualities against the chloroquine-resistant parasite Plasmodium falciparum, however more study is needed.[17]

Anti-lithiatic Activity:
Research on animals has demonstrated that plant ethanol extract is effective in treating kidney stone disorders by preventing oxidative stress, calcium oxalate urolithiasis, and lipid peroxidation. Treatment with plant decoctions decreased lipid peroxidation, calculogenesis-induced urine excretion, and calcium oxalate kidney deposits, suggesting anti-urolithiasis and antioxidative qualities.[18]

Anti-obesity Activity:
According to a research, plant decoctions considerably reduced total cholesterol,triglycerides, free fatty acids, and total protein in mice while dramatically raising high-density lipoprotein cholesterol levels.[19]

Analgesic Activity:
It was discovered that lyophilized plant decoctions have analgesic effects. [20]

Repellency Activity:
Using the steam distillation process, the study examined how well essential oils derived from leaves might resist the malaria parasite Anopheles stephensi in mosquito cages.[21] We looked at each essential oil in three different concentrations. There was a noticeable repelling effect from the essential oils of the plant. [22]

Hypotensive Activity:
The study examined the effect of leaf decoctions on circulation in animals under sedation. The decoctions considerably lowered mean arterial blood pressure, according to the results, and greater dosages decreased heart rate without changing it.[23]

Homeostasis activity:
Plant-based flavonoids, which stimulate osteoblasts and inhibit osteoclasts, can control bone homeostasis. T. procumbens fraction (TPF) has the potential to treat disorders such as osteoporosis associated with bone loss by blocking RANKL-induced osteoclast growth and pit formation in primary osteoclastic cells. In mice, TPF boosted bone formation indices and inhibited the growth of osteoclasts.[24]

Table No 1: Parts of the Tridax procumbenc Linn plant that have pharmacological action.

Plant parts	Pharmacological activity
Complete plant	Antimicrobial action directed against bacteria, including gram-positive and gram-negative. Anti-inflammatory, Anticoagulant
Leaves, **Flawers** **And** **Aerial sections:** **Leaves**	Insecticidal, parasiticidal, and antiseptic Hepatoprotective agent, Wound recovery. To assess bleeding from wounds, bruises, and cuts. Activity that hypotensives Anti-diabetic actions, Diarrhea, Dysentery To stop hair loss and encourage hair growth in the face of conjunctivitis. Immunomodulatory characteristic Activity that repels insects.

Table No 2: Pharmacological properties of *Tridax procumbens*

Pharmacological Properties	Effect	Phytochemical
Antimicrobial Activity	Antibacterial and fungal infections, Bacillus subtilis, E. coli, Pseudomonas aeruginosa	Alpha and Beta Pinenes, Alkaloids
Antifungal Activity	Candida albicans, Trichophyton rubrum, Trichophyton mentagrophytes, Microsporum fulvum, Microsporum gypseum, Dermatophytes, and Trichosporon beigelii	Flavonoids, Monoterpenes, and Alkaloids
Anti-diabetic Activity	Rats with antidiabetic action similar to that of the medication Glibenclamide.	Saponins
Antibacterial Activity	Salmonella group C, Salmonella paratyphi, E. Coli, Bacillus cereus, Mycobacterium smegmatis, Staphylococcus aureus, Klebsiella sp., and Streptococcus pneumoniae	Alpha and Beta Pinenes
Hepatoprotective Activity	Rats had reduced levels of oxidative stress, serum bilirubin, serum Alanine aminotransferase, serum Aspartate aminotransferase, and serum Alkaline Phosphatase	Alkaloids, Flavonoids
Immunomodulatory Activity	Rats' immune systems being activated and their percentage of neutrophils rising	Sequesterpene and triterpenoids
Antioxidant Activity	anti-inflammatory, anti-cancer, and antioxidant	High phenol content , Flavonoids (in water phase), Carotenoids (in lipid phase), Alkaloids
Antiparasitic activity	Colic, diarrhea, anti-Leishmaniasis action, and malaria	(3,S)-16,17-Didehydr ofalcarinol an oxylipin.
Anticancer Activity	Strong cytotoxic action on cancerous tumor cells.	5(alpha)- cholestane, monoterpenes (alpha and beta pinenes)
Antihypertensive Activity	Rats with antihypertensive action similar to captopril	Flavonoids and potentially alkaloids

PHYTOCHEMICAL SCREENING:

- **Alkoloids:**
  Concentrated extract and HCl were combined in a test tube, which was then heated for twenty minutes, cooled, and filtered in preparation for the next test.

  Dragendroff's test: When Dragendroff's reagent is added to the filtrate, the presence of alkaloids is indicated by the production of a brown, reddish precipitate.

  Mayer's test: When Mayer's reagent is added to the filtrate, the presence of alkaloids is indicated by the production of a cream-colored precipitate.

  Wagner test: When Wagner's reagent is added to the filtrate, a brown, reddish precipitate forms, which indicates the presence of alkaloids.

  Hager's test: The precipitate's yellow color revealed the presence of alkaloids in the filtrate following treatment with Hager's reagent.

- **Carbohydrate:**

  Molisch's test: One milliliter of extract was mixed with Molisch's reagent, and then concentrated H2SO4 was added from the test tube's sidewalls.

  Benedict's test: After adding Benedict's reagent to one milliliter of extract, it was quickly heated. [25]

- **Flavonoid:**
  Alkaline reagent test: The presence of flavonoids in the extract may be identified by the bright yellow hue that results from treatment with a 10% NaOH solution.

  NH4OH test: The observation of yellow fluorescence in 3 milliliters of extract containing 10% NH4OH solution indicated a positive test result.

  Mg turning test: After applying magnesium turning to the extract, HCl and 95% ethanol are added to the mixture, causing the mixture to become blood red.

  Zn test: The red hue that appeared when the extract was treated with Zn dust and HCl indicates the presence of flavonoids in the extract.

- **Tannin:**
  Lead acetate test: When two milliliters of extract were added to one percent lead acetate, a yellowish precipitate was produced, indicating the presence of tannins.

  FeCl3 (5%) test: The presence of condensed tannin is shown by the green color that results from treating 4 ml of extract with 4 ml of FeCl3.[26]

- **Saponin:**

  Foam test: After mixing 20 ml of distilled water with 5 ml of extract, the graduated cylinder was shaken for 15 minutes to form foam, which is a sign of saponin.
- **Steroids:**

  Salkowski's test: In order to identify steroids, mix the extract with 0.5 milliliter of chloroform and add concentrated sulfuric acid (H2SO4) from the test tube's sidewalls. [27]

Table No 3: Phytochemicals screening test

Phytoconstituents	Test	*Tridax procumbens*
Alkoloids	**Dragendroff's test**	+
	Mayer's test	+
	Wagner test	+
	Hager's test	+
Carbohydrate	**Molisch's test**	+
	Benedict's test	+
Flavonoid	**Alkaline reagent test**	+
	NH4OH test	+
	Mg turning test	+
	Zn test	+
Tannin	**Lead acetate test**	+
	FeCl3 (5%) test	+
Saponin	**Foam test**	-
Steroids	**Salkowski's test**	+

CONCLUSION:

This study highlights how crucial it is to do research on plants used in traditional medicine in order to create new drugs. A plant with a long history of traditional usage, Tridax procumbens, has been utilized to separate metabolites and treat a variety of ailments. Repeatability issues have arisen because the pharmacological characteristics of each phytochemical were not sufficiently taken into account during isolation and evaluation. Different extraction methods have been employed to treat different diseases, however numerous studies have either failed to support or contradict one another. Research indicates that Tridax is a more effective anti-diabetic drug than conventional therapies. Subsequent research endeavors have to concentrate on the correlation among certain phytochemicals and their impact on diverse categories of ailments. In aspects like physiological activity, concentration, and extraction yield, further study is required. These discoveries will be helpful in the development of novel drugs or preventative healthcare.

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