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Tridax procumbens Linn.: Ethnobotanical Significance, Pharmacognostic Profile, and Pharmacological Activities

Simran Tanwar[1], Vandana Mahawar[1], Shaily Chaudhary[1*], Satish Prajapati[1], Sajal Simaiya[1], Shalini Chouhan[1], Shruti Pundkar[1], Santosh Malviya[1], Sardar Thakur[1], Akash Yadav[2]

1. Compfeeders Aisect College of Professional Studies, Pharmacy College, Rangwasa, Indore (M.P.), India
2. IPS Academy College of Pharmacy, Knowledge Village, A.B. Road, Rajendra Nagar, Indore (M.P.), India

Corresponding Author*

Dr. Shaily Chaudhary

Head & Professor, Compfeeders Aisect College of Professional Studies, Pharmacy College, Rangwasa, Indore (M.P.), India

Email Id: s.shailychaudhary@gmail.com

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Abstract

In India, Tridax procumbens (L.) is a spreading annual herb. Originally from tropical America, the plant has spread to tropical Africa, Asia, and Australia. The locals name it “Ghamara,” which is also known as “coat buttons” in English. Some Ayurvedic practitioners prescribe it as “Bhringraj.”

Tridax Procumbens is a member of the Asteraceae family and is a medicinal plant that is also referred to as coat button, kansari (Hindi), or ghamara. This herb is used by various communities and is mostly employed in Indian traditional medicine. It is a very promising species that produces secondary metabolites with a wide range of purported therapeutic applications, including alkaloids, steroids, carotenovonoid (catechins, centaurein, and bergenins), fatty acids, phytosterols, tannins, and minerals. Pharmacologically, Tridax procumbens is widely known for its antibacterial, antifungal, antioxidant, hepatoprotective, anticancer, antidiabetic, immunomodulatory, wound healing, and hypotensive qualities. The taxonomy, morphology, geographic distribution, phyto-constituents, and pharmacological activity of T. Procumbens are all thoroughly covered in this review study.

Keywords: Tridax procumbens, Phytochemicals, Biological activity, Hepatotoxic, Antimicrobial, Antioxidant activity**.**

Introduction

Tridax procumbens Linn is a common medicinal herb which is best known as a widespread weed and pest plant distributed throughout India. It grows in open spaces, sunny, arid locations, fields, roadside ditches, waste areas, meadows, dunes, and coarse-textured tropical soils. It is an annual creeper herb that is semi-Tridax prostate. The

coat button is a common name for Tridax procumben.[1] Other names for Tridax procumbens include the "Mexican daisy" in Mexico, the "Coat button" and the "Tridax daisy" in English, the "Jayanti Veda" in Sanskrit, the "Ghamra" in Hindi, the "Dagadipala" in Marathi, and the "Vettukkaaya-thalai" in Tamil (Ingole et al.,2021)[2,3]. It is a perennial plant that is a member of the Asteraceae family. Although it originated in the tropical Americas, it has since spread to mild temperate and tropical subtropical regions across the globe.[4] With a variety of pharmacological qualities, such as wound healing, antioxidant, antibacterial, antifungal, immunomodulatory, anti-inflammatory, antidiabetic, vasorelaxant, antihyperlipidemic, analgesic, antiplasmodial, anticoagulation, and antihepatic effects, T. procumbens has been used for centuries in the Ayurvedic system. Tridas procumbens can grow in both dry and wet conditions and is tolerant of a wide range of soil types.[5] Certain cultures believe that the leaves and flowers have therapeutic qualities and are used to heal illnesses like skin diseases, fever, and stomach issues.

Synonyms[6,7]

- ✓ **Scientific name**
  - ✓ Amellus pedunculatus Ortega ex Wild
  - ✓ Balbisia canescens Rich. Ex Pers.
  - ✓ Balbisia divaricata Cass
  - ✓ Balbisia elongata Wild.
  - ✓ Balbisia elongata Wild.
  - ✓ Chrysanthemum procumbens (L.) Sessé & Moc.
- ✓ **Common name**
  1. **Hindi** - Khal muriya, Tal muriya, Ghamra
  2. **Sanskrit** - Jayanti Veda
  3. **English -** Coal buttons, Tridax Daisy, Wild daisy
  4. **Marathi** - V Gaddi Chemanthi
  5. **Tamil** - Vettukaya thalai, Thatha

Plant Morphology

Habitat

The description of Tridex procumbens as a prostrate plant suggests that it grows by trailing or creeping. Instead of growing straight, it usually spreads horizontally and grows near to the ground.[8]

Description

1. **Stem**

Tridex procumbens stems are cylindrical, hispid, covered in millimeter-long multicellular hairs, and have a powerful transport system. The plant steam is branching, ascending 30 to 50 centimetres in height, sparsely hairy, and rooted at nodes. Their ability to creep or trail may enable the plant to spread out over the ground and take on the appearance of a mat.

2. **Roots**

Tridex procumbens is a prostrate plant, meaning it probably has a shallow root system that is mostly

concentrated close to the soil's surface. In addition to serving as the plant's anchor, these roots would take up nutrients and water from the surrounding soil.

3. **Flowers**

The plant Flowers are looking like daisy. The Flower having tubular shape, indicating that the petals are fused together to form a tubelike structure. The center of the flower is yellow.

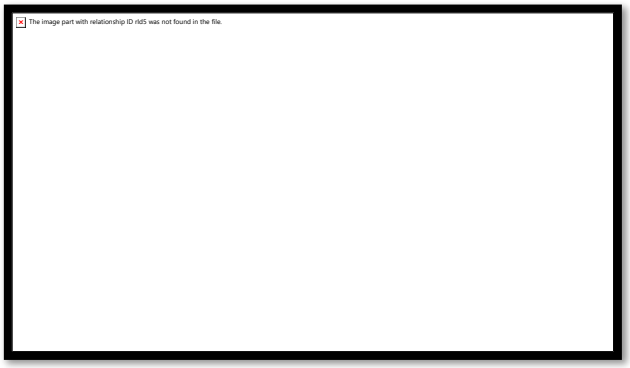
4. **Leaves**

The leaves are often arrow-head shaped and have uneven teeth. They range in size from 3 to 7 cm and are lanceolate, ovate, opposite, exstipulate, and simple. Basal leaf with a wedge form, small petioles, and hair on both sides.

5. **Fruits:** The fruit is conical achene that is 3.5mm high, pubescent, and matures from brown to black. When fully grown, it is encircled by a horizontally prostrate pappus of fluffy bristles.[9]

6. **Growth**

Tridax Procumben forming patches with flowering axis reaches 50cm.[10]



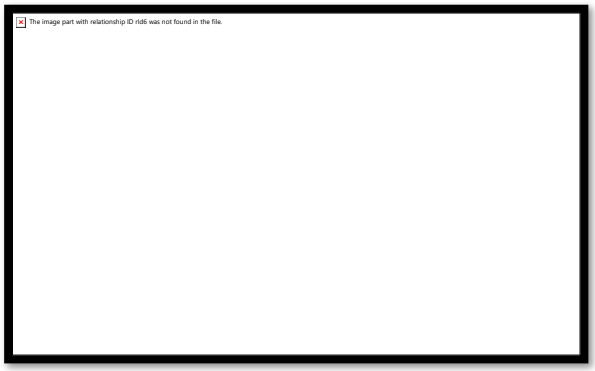
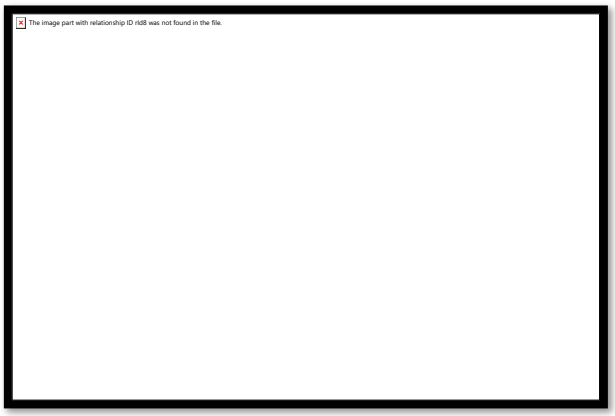


Fig.1 Stem of Tridax Procumbin LinnFig.2 Root of Tridax Procumbin Linn



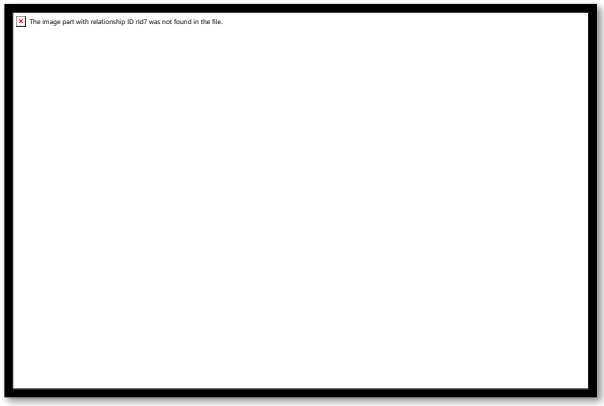


Fig. 3 Flower of Tridax Procumbin Linn **Fig.4 Leave of Tridax Procumbin Lin**

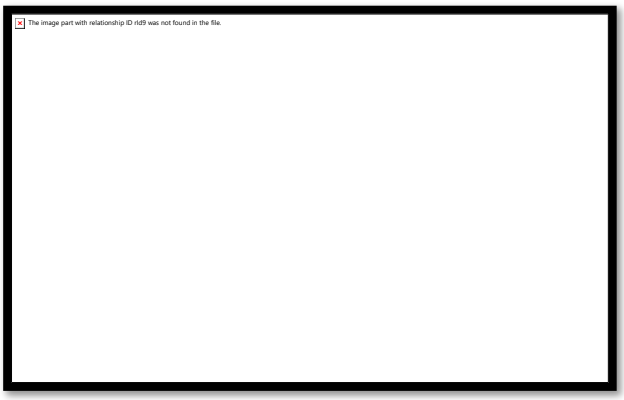


Fig. 5 Fruit of Tridax Procumbin Linn

Table 1: Classification of *Tridax procumbinlinn*[10]

S. No.	Classification	Scientific Name	Biological Name
1.	Kingdom	Plantae	Plant
2.	Subkingdom	Tracheobionta	Vascular plants
3.	Division	Spermatophyta	-
4.	Subdivision	Magnoliophyta	Flowering plants
5.	Class	Magnoliopsida	Dicotyledons
6.	Subclass	Asteridae	-
7.	Order	Asterales	-
8.	Family	Asteraceae	Aster family
9.	Genus	Tridax L.	Tridax
10.	Species	Tridax procumbens l.	Coat buttons

Plant Uses

1. Typhoid fever, cough, feverish stomachache, and backache can all be treated with the entire plant. The leaves' decoction is used to treat malaria, reduce discomfort, and treat gastrointestinal and abdominal mycosis.
2. The anti-inflammatory properties of medicinal plant leaf extract were similar to those of aspirin and ibuprofen. Whole arial portions contain antisecretory (antidiarrheal) and hepatoprotective properties. It works against fungi, bacteria, and protozoa. Leaf juice aids in the healing of dead space wounds.

3. Within eight hours of dosing, the amino sugar induces fulminant hepatitis due to endotoxin toxicity, which is known to preferentially inhibit transcription and indirectly hepatic protein synthesis.

Pharmacognostical Studies [4]

Microscopy

1. **Root :** The root's TS has a circular shape; the outer layer is made up of two to three layers of cork cells with an exfoliating outer layer, followed by a narrow cortex region made up of eight to nine layers of parenchymatous cells with some oil globules; adjacent to the cortex is a broad xylem region encircled by a narrow band of phloem; the xylem is made up of vessels, fibers, and xylem parenchyma, and is traversed by multiseriate medullary rays that extend radially through the xylem up to the phloem, giving the appearance of a wedge to the xylem elements. (Fig. 6)

- ✓ **Stem:** The stem's TS has a nearly round shape, a few multiseriate covering trichomes, and an outer single-layered epidermis covered in cuticle; The thin cortex is made up of one to two layers of collenchymatous cells, two to three layers of chlorenchyma cells, and a layer of parenchyma; A ring of 19 to 20 vascular bundles, surrounded by discontinuous patches of pericyclic fibers, is arranged at the inner cortex. The vascular bundles are conjoint, collateral, and open, and they are connected by a ring of 2 to 4 layered cambium. Phloem is located outside, while endarch xylem is located towards the inner side. The xylem is made up of vessels, fibers, and xylem parenchyma; protoxylem elements are visible towards the pith region; the pith is very broad and parenchymatous. (Fig. 7)
- ✓ **Leaf :** The leaf's TS has a lower convex midrib surface with lateral laminar expansions and an upper raised midrib surface. (Fig. 8)
- ✓ **Petiole:** Kidney that is crescent-shaped on the laminal side and kidney-shaped near the distal end. Cuticle-covered single-layered epidermis that is broken up by basic, multicellular, three- to five-celled trichomes. One- and two-celled collenchymatous hypodermis. Ground tissue is parenchymatous; vascular bundles 5 vary in size from the center to the periphery, meaning they can be large or small. These are centripetal, meaning that the phloem envelops the xylem. (Fig. 9)
- ✓ **Lamina:** In the TS of lamina, the mesophyll tissue differentiates into a row of upper palisade cells, followed by four to five layers of spongy parenchymal cells that are traversed by veins; the lamina and midrib contain some cell contents. The upper and lower single-layered epidermis is covered by thin cuticle and has many covering trichomes.

Fig. 6 TS of Root

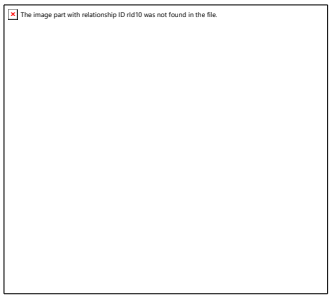


Fig. 7 TS of Stem

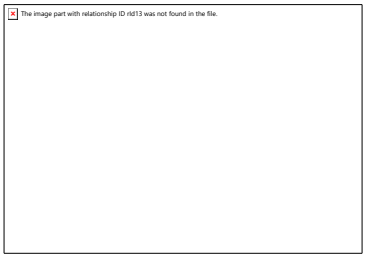


Fig. 8 TS of Leaf

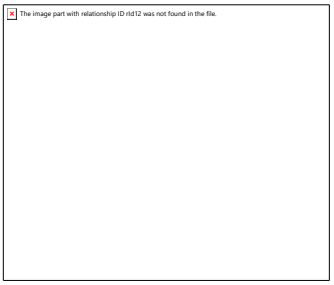


Fig. 9 TS of Peiole

Phytochemical Studies

1. Flavonoids

Twenty-three flavonoids with a total amount of about 65 g/kg have been found in T. procumbens, according to a recent study. About 17.59% and 26.3%, respectively, are made up of kaempferol, catechin, and its derivatives (-)-epicatechin, (+)-catechin, (-)-eigallocatechin, (+)-gallocatechin, (-)-Epigallocatechin-3-Gallate (EGCG), and (-)-Epicatechin-3-Gallate. Biochanin, apigenin, naringenin, daidzein, quercetin, butein, robinetin, baicalein, nobiletin, genistin, ellagic acid, luteolin, myricetin, baicalin, isorhamnetin, and silymarin are among the sixteen flavonoids that make up the remaining 56.11%.[10]

2. Alkaloids

Any family of nitrogenous organic chemicals derived from plants that have significant physiological effects on people is referred to be an alkaloids. T. procumbens has also been discovered to contain some alkaloids (Kumar et al., 2012).[11] Thirty-nine alkaloids were found in a phytochemical screening examination utilising aqueous extraction of the leaves, primarily Voacangine (22.33%) and Akuamidine (73.91%) (Ikewuchi, 2012).[12] The extract had tannins and sterols in addition to alkaloids. T. procumbens pedicle and bud alkaloids demonstrated antibacterial action against Candida albicans and Proteus mirabilis, while bud alkaloids demonstrated antimicrobial activity against Trichophyton mentagrophytes and E. coli. According to Jindal and Kumar (2012), the total alkaloids in the pedicles

were 32.25 mg/gdw, whereas the total alkaloids in the buds were 92.66 mg/gdw.[13]

3. Saponins

T. procumbens has been found to possess a steroidal saponin and pB-Sitosterol-3-O-β-D-xylopyranoside in its blooms. Saponins are steroidal glycosides with pharmacological and therapeutic qualities. Another study found that by blocking the sodium glucose co-transporter-1 (S-GLUT-1) in the intestines of male Wistar albino rats, saponins from an ethanolic extract of T. procumbens may have antidiabetic effects.[14]

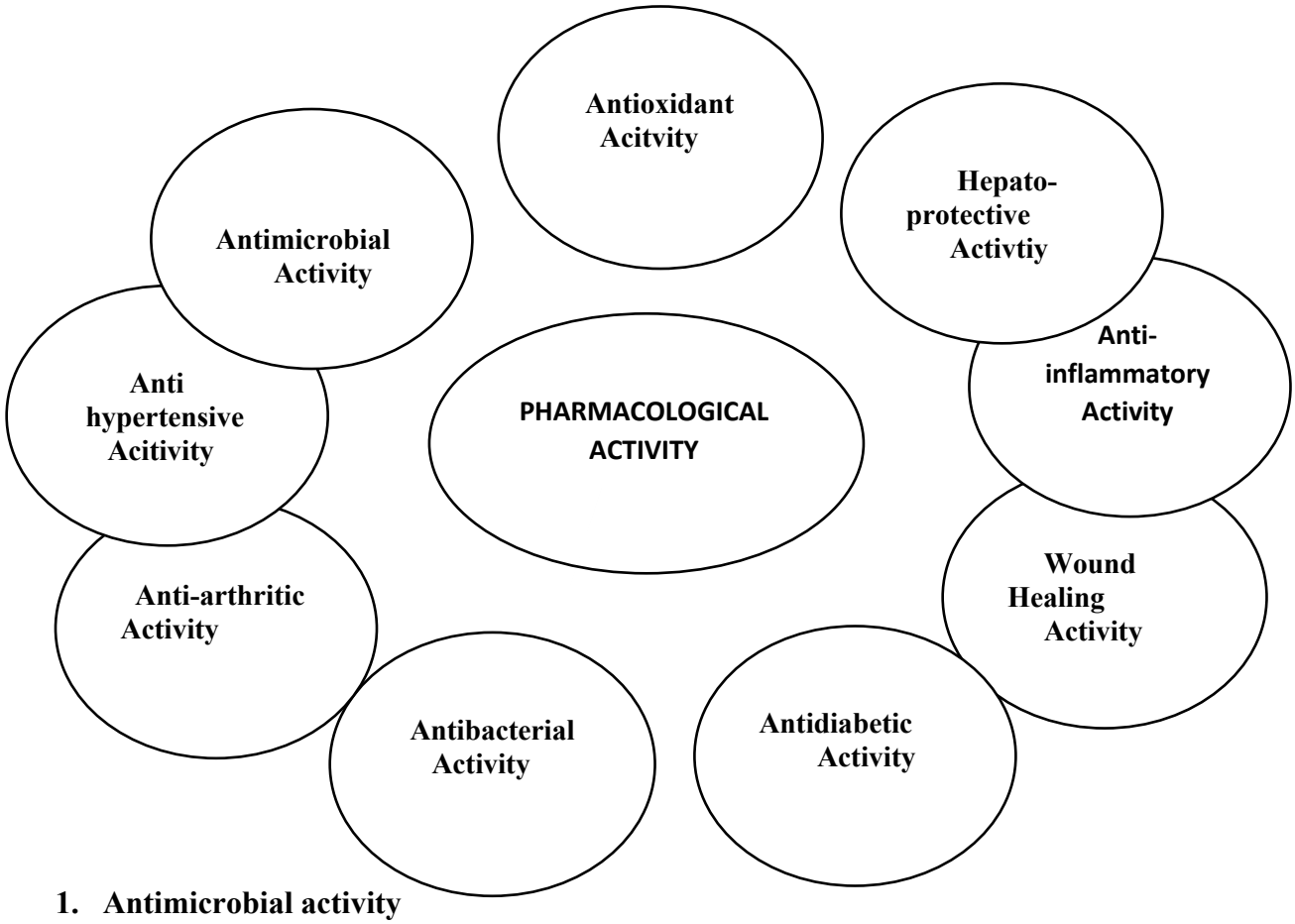
4. Tannins

Plants naturally contain water-soluble polyphenols called tannins. Antimicrobial qualities are possessed by tannins as well as antimutagenic and anticarcinogenic qualities, possibly as a result of their antioxidant capacity. Tannins are present in T. procumbens, according to several studies. Water and acetone Water and chloroform displayed the. Tannins are present in T. procumbens leaf extracts. The buds and pedicle of T. procumbens contain tannins.[15]

5. Carotenoids

Plants use carotenoids, which are fat-soluble pigments present in leaves, for three primary purposes: absorbing light, preventing photooxidative damage, and attracting insects with their colour. It has been hypothesised that carotenoids shield DNA from oxidative stress. T. procumbens has yielded a variety of secondary metabolites, including as beta-carotene, which is essential for the upkeep of epithelial tissues and can be transformed into vitamin A. A lack of vitamin A can cause xerophthalmia, night blindness, and problems with immunity and haematopoiesis. Beta-carotene and lutein are two carotenoids that have demonstrated efficacy in reducing UV-induced erythema.[16]

Pharmacology Activity



1. Antimicrobial activity

Although antimicrobial tests have been conducted, more research is required to validate some of the findings. Numerous bacterial and fungal species have demonstrated susceptibility to T's antibacterial qualities. procumbens. Silver nanoparticles with some antibacterial action against E. coli have recently been synthesised using the callus of stems and leaves. V. cholerae, A. coli, V. and A flavus. These results are not certain, though, because the activity was lower than that of silver nitrate. T. procumbens leaf extracts in ethanol, petroleum, and ether demonstrated antibacterial efficacy against Bacillus faecalis. It was stated that the presence of alkaloids was most likely the cause of this behaviour. According to Christudas, the chloroform extracts shown antibacterial activity against B. faecalis, B. subtilis, E. coli, and Pseudomonas aeruginosa; nevertheless, the tests require improved controls and protocol descriptions. Alpha and beta pinenes, which are found in trace amounts in T. procumbens essences, can aid in the treatment of bacterial and fungal illnesses.[17]

2. Antioxidant activity

Phagocyte-generated oxygen free radicals trigger the transcription factor NF-κB, which in turn triggers the activation of cyclooxygenase-2 (COX-2) and the production of inflammatory cytokines. This starts

a chain reaction of tissue damage that needs to be stopped. T. Procombens has antioxidant properties. DPPH (2, 2-diphenyl-picrylhydrazyl hydrate) and ABTS [2, 2'-azino-bis (3-ethyl benzothiazoline-6-sulphonic acid)] techniques were used to validate this. The ethanol extract's chloroform and ethyl acetate fractions exhibited the highest activity in the DPPH technique, with IC50 values of 37.39 µg/ml. Additionally, using the DPPH technique, methanol extract demonstrated antioxidant activity.[20,21] The action is mostly caused by the extracts' flavonoids and alkaloids.[18]

3. Hepato-protective Activity

Hepato-cellular damage caused by DGalactosamine/lipopolysaccharide was significantly reduced by the hepato-protective properties of leaves. Due to their capacity to harm liver cells, these substances have been suggested to be hepato-toxic. Human viral hepatitis and the multifocal necrosis caused by D-galactosamine are comparable. Within eight hours of dosing, this amino sugar blocks the transcription process and indirectly inhibits the synthesis of liver proteins, resulting in toxicity and hepatitis.[19]

✓ **Anti-inflammatory activity**

Tridax procumbens has anti-inflammatory properties that significantly reduce paw oedema in rats with carrigean-induced paw oedema when taken with the standard medication ibuprofen. Tridax procumbens is equally effective when taken orally when combined with ibuprofen, and its effects with different dosage regimens demonstrate stronger anti-inflammatory properties than ibuprofen alone.[20]

✓ **Wound healing activity**

The intricate and ever-changing process of wound healing can repair tissue layers and cellular systems. Water extract from the entire Tridax procumbens L. plant can restore normal wound healing in rats with weakened immune systems. Without influencing its anticontraction and antigranulation properties, Tridax counteracted the antiepithelization and tensile strength-depressing effects of dexamethasone, a well-known healing suppressant. This plant material's wound healing method entails intricate interactions between dermal and epidermal cells, the extracellular matrix, controlled angiogenesis, and proteins generated from plasma, all of which are regulated by a variety of growth factors and cytokines.[21]

✓ **Antidiabetic activity**

There is diabetes mellitus everywhere. Despite being prevalent worldwide, diabetes is ranked in the top 10 global disorders and may potentially be in the top 5. Indians have lived there since prehistoric times, according to history. Madhumeha is another term for diabetes, a condition in which the patient has sweet urine and exhibits sweetness throughout their body, including in their blood, urine, mucus, and sweat. It has been demonstrated that Tridax procumbens dried leaf extracts in petroleum ether, alcoholic, and water exhibit hypoglycemic effects in wister rats.

✓ **Antibacterial activity**

It has been demonstrated that Tridax procumbens has antibacterial properties. In rural areas of the world, it is one of the most widely used herbs to cure bacterial illnesses. Extracts from Tridax have demonstrated efficacy against a range of microorganisms. N-hexane extracts are effective against

Salmonella group C, Salmonella paratyphi, E. coli, Mycobacterium smegmatis, and Klebsiella sp. Gram-negative bacteria like Klebsiella sp. And Gram-positive bacteria like Bacillus cereus, Mycobacterium smegmatis, and Staphylococcus aureus were both successfully combatted by the ethyl acetate extract. Staphylococcus aureus and Streptococcus pneumoniae are two Gram-positive bacteria that are significantly inhibited by T. procumbens essential oil extract.[22]

✓ **Anti-arthritic activity**

An inflammatory condition that affects one or more joints is called arthritis. When compared to the common medication indomethacin, the ethanolic extract of T. procumbens demonstrated a significant involvement in the anti-arthritic activity in the rat model caused byFreund's Complete Adjuvant (FCA). Body weight, RBC count, and haemoglobin level increased, but ESR, WBC count, pannus production, and bone degradation decreased. The loss of articular cartilage in rheumatoid arthritis causes severe swelling of soft tissues through a variety of pathological mechanisms and bone resorption. These symptoms were normalised by administering an ethanolic extract of T. procumbens, confirming the extract's anti-arthritic properties.[23]

✓ **Antihypertensive activity**

Regardless of diastolic and systolic blood pressure, elevated pulse pressure is predictive with myocardial infarction (MI), coronary artery disease, and congestive heart failure. On the other hand, tachycardia, or an elevated heart rate, is linked to a higher risk of dying from both cardiovascular and non-cardiovascular causes. In the Sprague-Dawley rat models, the aqueous extract of T. procumbens leaves decreased heart rate and mean arterial blood pressure.[24]

✓ **Hypotensive activity**

Tridax procumbens leaf's hypotensive impact was examined in Sprague-Dawley rats under anaesthesia. They demonstrated that the aqueous extract from leaves has cardiovascular effects and can significantly lower mean arterial blood pressure in dose-dependent ways. While the lesser dose had no effect on heart rate, the greater dose showed a considerable decrease in it. According to reports, Tridax procumbens Linn. Leaves have a hypotensive action.[25]

✓ **Antifungal Activity**

Tridax procumben exhibits antifungal action in many parts, and its leaves have a very strong effect on Fusarium oxysporum. Tridax procumben oil exhibits strong antifungal properties against the fungus Candida tropicalis. Tridax procumben's flavonoids have strong antifungal properties against Candida albicans. Methanol found in Tridax procumben roots has antifungal properties against a variety of fungus, including Candida glabrata. Tridax procumben leaves contain methanol, which has antifungal properties against Candida tropicalis.[26]

✓ **Anti-ulcer activity**

In rats with ethanol-induced ulcers, 400 mg/kg of Tridax procumbens ethanolic leaf resulted in dose-dependent reduction of the ulcer lesion index as well as alterations in stomach pH and volume. The extract lowers the levels of glutathione (GSH), catalase, and superoxide dismutase (SOD) in the rat stomach and aids in the restoration of big fibroblast cells. Thus, these findings demonstrated Tridax

procumbens's medicinal potential.[27]

✓ **Blood Clotting and Haemostatic activity**

Leaves may be utilised as a strong haemostatic agent since water decoctions of the leaves demonstrated significant blood clotting activity. Because the grain alcohol extract shortens the duration in the blood samples of all the experiments, the haemostatic property of the plant's leaves of the various solvent extracts was determined in vitro using Lee-White's methods.[28]

Conclusion

Tridax procumbens is one of the most widely used herbal treatments in India. Tridax procumbens Linn. (Compositae) is a weed that originated in tropical America and has since spread to tropical Africa, Asia, and Australia. Every part of this plant has strong pharmacological qualities, and it is widely accessible.

Despite the long history of traditional usage of Tridax procumbens, the pharmacological properties of each phytochemical have not been sufficiently linked to their isolation and evaluation, and there may be issues with repeatability after isolation and evaluation.Research in these areas will provide useful information that the medical community can use to develop new drugs or provide preventative treatment. There are still many important traits about T. procumbens that are unknown.

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