

Review Article of Wound Healing Properties of *Tridax Procumbens*.

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ABSTRACT: *Tridax procumbens* (Asteraceae) is a widely distributed medicinal plant traditionally used for the treatment of wounds and skin disorders. This review aims to summarize the phytochemical composition, pharmacological activities, and wound healing potential of *Tridax procumbens*. A comprehensive literature survey was conducted using published research articles and scientific databases. The plant contains various bioactive constituents such as flavonoids, alkaloids, tannins, saponins, and carotenoids, which contribute to its therapeutic effects. Experimental studies demonstrate that *Tridax procumbens* promote wound healing by enhancing collagen synthesis, accelerating epithelialization, increasing lysyl oxidase activity, and stimulating angiogenesis. Its antimicrobial, antioxidant, and anti-inflammatory properties further support its effectiveness in wound management. In addition, the plant exhibits hepatoprotective, antidiabetic, and immunomodulatory activities. Despite promising preclinical findings, limited clinical evidence and lack of standardized formulations remain major challenges. Therefore, further research focusing on clinical validation and advanced drug delivery systems is required to establish its role in modern therapeutics.

Keywords: *Tridax procumbens*, Wound healing, Phytochemicals, Antioxidant activity, Herbal medicine, Tissue regeneration

I. INTRODUCTION:

The Asteraceae family includes *Tridax procumbens* Linn^[1]. "Bhringarj," a wild herb, is often used to treat liver conditions.^[2] Because of the look of flowers, it is widely referred to as Ghamra and, in English, "coat buttons." The herb has been widely utilized to treat a variety of illnesses in the Ayurvedic medical system. The plant is the innate of tropical America and enfranchised in tropical Africa, Asia, Australia and India. It is a wild herb found all over India. Because of its spreading stems and copious seed production, coat buttons are also found as a

weed along roadsides, waste grounds, dikes, railroads, riverbanks, and meadows.^[3] By preventing the production of scars, natural chemicals derived from plant extracts can help improve the healing process of wounds. Bioactive chemicals obtained from plants that are antimicrobial, antioxidant, and healing promote blood coagulation, combat infection, and hasten wound healing^[4,5]. The traditional Indian system makes extensive use of this plant. It is a Central American annual or perennial weed that grows throughout India, particularly in the states of Maharashtra, Madhya Pradesh, and Chhattisgarh^[6]. The process of repairing damaged tissues and restoring their functionality is known as wound healing. Different cell types participate in wound healing to restore tissue integrity. Even though all biological systems have built-in repair processes, tissue healing can be accelerated by providing external stimuli or support. Stimulants may include plant chemicals, collagen-specific enzymes, antiseptics, sulfa-antibiotics, skin barrier emollients, and corticosteroids^[7]. Moreover, it possesses a number of pharmacological characteristics, such as immunomodulatory, antioxidant, antihepatotoxic, analgesic, antidiabetic, anti-inflammatory, antifungal, and antibacterial activity^[8].

DESCRIPTION:

The plant produces three-toothed ray florets with white or yellow blooms. The leaves typically have an anchor form and are toothed. Its fruit bears a feathery, plume-like white pappus at one end and is firm achene with stiff hair. Scales or reduced to pappus are used to symbolize calyx. The fact that each plant can generate up to 1500 achenes, each of which can catch the wind in its pappus and travel a considerable distance, contributes to the plant's invasiveness. In regions with a tropical or semitropical climate, this weed grows in fields, meadows, crop lands, disturbed areas, lawns, and roadside ditches.^[9]

Tannins, flavonoids, glycosides, is oflavonoids, steroids, saponins, lipids, phospholipids, resins, sterols, reducing sugars, phenols, anthraquinone, and catechol were isolated, according to a review of the literature [10].

BOTANICAL DESCRIPTION:

The taxonomical classification of *T. procumbens* L. is shown in Table 1.

Kingdom	Plantae
Subkingdom	Tracheobionta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Asteridae
Clade	Angiosperms
Order	Asterales
Clade	Eudicots
Family	Asteraceae
Tribe	Heliantheae
Genus	Tridax
Species	<i>T. procumbens</i>
Binomial name	<i>Tridax procumbens</i>

Table 1. Taxonomical Classification [11].

PHARMACOLOGICAL ACTIVITIES AND PROPERTIES.

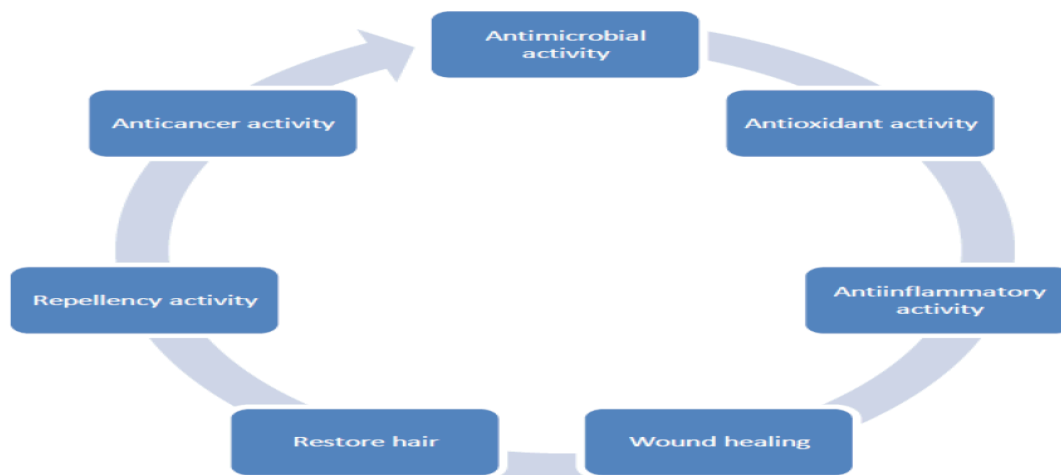


Figure:1 *Tridax procumbens* having various potential therapeutic activities.

TRADITIONAL USES: Significant anti-inflammatory, hepatoprotective, diabetic, and antimicrobial properties against both gram-positive and gram-negative bacteria are exhibited by *Tridax procumbens*. The leaf juice is used to stop bleeding from cuts, bruises, and wounds because it has antibacterial, insecticidal, and parasiticidal qualities.

WOUND HEALING ACTIVITY: Wound-healing activity When this plant material is applied to wounds, dermal and epidermal cells interact intricately with plasma-derived proteins that are regulated by a range of growth factors and cytokines. *Tridax Procumbens* (leaves) not only accelerated healing but also reversed the effects of steroids on healing in experimental male Wister rats. This plant also increases the amount of lysyl oxidase, protein, and nucleic acid in the granulation tissue due to the elevated concentration of glycosaminoglycan. The cellular structure and tissue layers can be repaired by the plant [12]. *Tridax procumbens* has a number of possible therapeutic uses, including wound healing, insecticidal, anti-inflammatory, antibacterial, antioxidant, and anti-inflammatory properties. Leaf juice is used as a hair tonic, to halt bleeding, and to heal new wounds. *Tridax procumbens* is mostly utilized in India as an insect repellent, anticoagulant, and antifungal. Leaf extract has been used in traditional medicine to treat infectious skin conditions. In addition to heartburn and gastritis, it is a well-known medication for liver problems or hepatoprotective properties. *Tridax procumbens* has a number of potential medicinal uses and is utilized as a bio absorbent to remove hazardous Cr (VI) from industrial wastewater. [13].

The leaves are used to treat bronchial catarrh, dysentery, diarrhea, stop hair loss, encourage hair growth, and repel insects. It's interesting to note that it also has strong immunomodulatory and hypotensive effects. The plant's leaves are used as a cure for conjunctivitis by traditional healers and the indigenous populations of the West African

subregion and tropical zone of the world. Additionally, it serves as a bioadsorbent for chromium (VI), one of the extremely hazardous ions discharged into the environment by chrome winding and leather processing.

[14].

1) Healing: Traditional medical systems have made extensive use of *Tridax procumbens* to treat cuts, bruises, and wounds. Its anti-inflammatory and antibacterial qualities aid in infection prevention and expedite healing.

2) Skin Disorders: The herb is applied topically to treat dermatitis, rashes, and eczema, among other skin conditions. Its calming and anti-inflammatory properties can relieve inflammation and itching.

3) Fever Reduction *Tridax procumbens* is used in some traditional methods to lower fever. It is frequently made as an infusion or decoction and used orally.

4) Gastrointestinal Issues *Tridax procumbens* is used to treat stomachaches, diarrhea, and other gastrointestinal issues since it is thought to have digestive advantages. It might support digestive health and lessen discomfort.

5) Respiratory Conditions *Tridax procumbens* is utilized as a treatment for respiratory conditions like bronchitis, colds, and coughs in several cultures. It is frequently made as a decoction or herbal tea. [15].

WOUND HEALING ACTIVITY: A wound is characterized as an injury to the body (such as from assault, an accident, or surgery) that usually results in damage to underlying tissues and a laceration or breaking of a membrane, such as the skin [16]. Open wounds and closed wounds are the two categories of wounds. [17]. A series of carefully planned biochemical and cellular processes are involved in the intricate multiphase process of wound healing. In general, the process can be divided into three phases: remodeling, proliferation, and inflammation. The repair process depends on the involvement of different inflammatory cells. Neovascularization results from these cells' promotion of endothelial cell migration and proliferation [18]. Angiogenesis, collagen deposition, granulation tissue development, epithelization, and wound contraction are characteristics of the proliferative phase. Lastly, as part of tissue remodeling, the fibroblasts proliferate and create extracellular matrix. At the site of injury, several growth factors and cytokines regulate these interconnected activities [19]. In addition to causing morbidity for the patient, impaired wound healing can result in complications such as dehiscence and chronic wound healing ulcers [20]. Steroid use along

with supportive antibiotics is currently the mainstay of treatment, however it has several undesirable side effects. Thus, the development of therapeutic substances that enhance the healing process is necessary. Fresh *Tridax procumbens* leaves have been shown in local literature to have the ability to heal cutaneous wounds. [21,22].

OPEN WOUNDS: Open wounds are classified as, Lacerations are messy-looking wounds created by tearing or crushing power, whereas incisions or incised wounds are formed by a clean, sharp-edged weapon like a knife, razor, or glass splinter. Incisions and lacerations can have a stellate (irregular) or linear (regular) appearance. When referring to incisions, the term "laceration" is frequently used incorrectly. Abrasions (grazes) are superficial wounds where the epidermis, the skin's outermost layer, is scraped off. A sliding fall onto a rough surface, such concrete, asphalt, or tree bark, frequently results in abrasions. Avulsions are injuries where a bodily part is violently separated from its natural location of insertion. This kind of amputation involves pulling the limb off instead of cutting it off. Puncture wounds are the result of an item, like a splinter, nail, or needle, piercing the skin. Penetration wounds are those that result from an instrument, such a knife, penetrating and exiting the skin. [23].

CLOSED WOUND: Closed wounds are categorized as [24]. A collection of blood outside of blood arteries is called a hematoma. It happens when blood leaks into tissues due to injury to the wall of a blood vessel (artery, vein, or capillary). In contrast to hemorrhage, which denotes active, continuous bleeding, hematoma refers to blood that has essentially clotted. One example of a hematoma is a bruise. Hematomas occur when a blood artery wall is damaged during surgery, allowing blood to seep into the surrounding tissues. or crush injury, which is brought on by an extremely high force applied over an extended length of time. A variety of cytokines and growth factors regulate the interaction between epidermal cells, dermal cells, extracellular matrix, controlled angiogenesis, and plasma-derived proteins during wound healing. [25].

INDIAN NAMES: [26].

Hindi	Ghamra.
Sanskrit	Jayanti Veda.
Marathi	Dagadi Pala and Ghav Pala,
Telugu	Gaddi Chemanthi.
Tamil	Thatapoodu.
Malayalam	Chiravanak.

MORPHOLOGICAL FEATURES: The tiny perennial herb *Tridax procumbens* L. has short, hairy leaves that resemble blades. Corolla has a yellow hue. It is a common weed that thrives in fields, waste areas, meadows, dunes, sunny dry locations, and the coarse-textured soils of tropical countries. It is an annual creeper herb that is semi-prostrate.^[27]

PATHOPHYSIOLOGY OF WOUND HEALING:^[28]

The normal wound repair process consists of four phases that occur in a predictable sequence:

- Hemostasis.
- Inflammation.
- Proliferation.
- Remodeling.

1.Haemostasis: Blood arteries nearby contract to lessen blood loss when a wound occurs. After that, platelets congregate at the injury site to create a transient plug that stops the bleeding. Hemostasis is the term for this process.

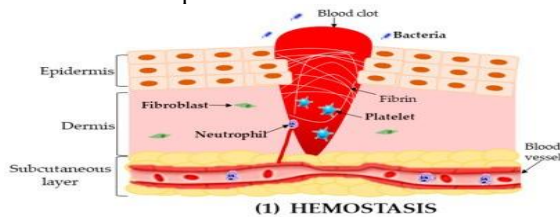


Figure: 2 Hemostasis.

2.Inflammation: The inflammatory phase starts after Hemostasis. Cells that cause inflammation Macrophages and neutrophils, for example, go to the wound site to eliminate dead cells, debris, and foreign objects. Additionally, a number of cytokines and growth factors are released during this phase, which aid in controlling the healing processes that follow.

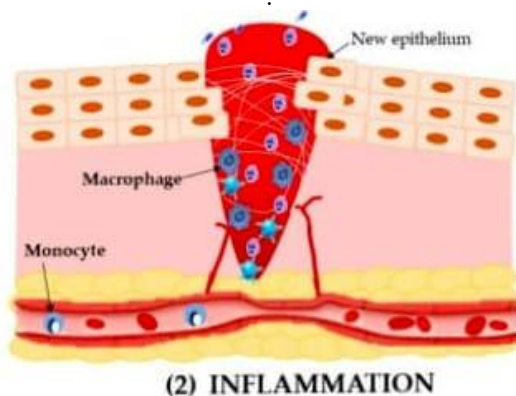
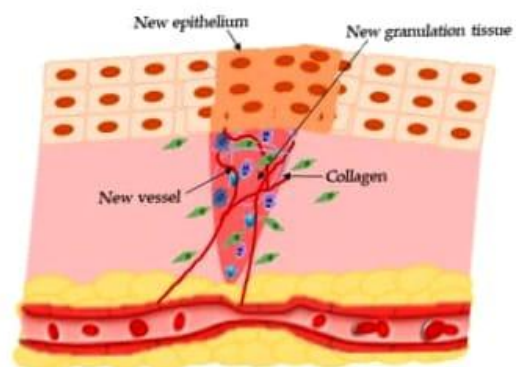


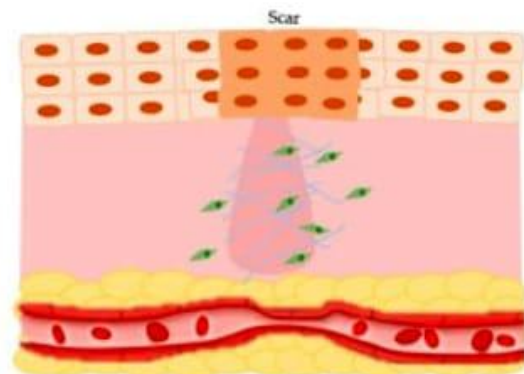
Figure: 3 Inflammation.

3.Proliferation: New tissue is created to replace lost or injured tissue during the proliferation phase. Collagen, a crucial part of the extracellular matrix that gives the healing tissue structural support, is produced by fibroblasts that migrate to the wound site. During this stage, angiogenesis—the creation of new blood vessels—also takes place to supply the growing tissue with nutrition and oxygen.



(3) PROLIFERATION
 Figure:4 Proliferation.

4. Remodeling: Remodeling is the last stage of wound healing and might take months or even years. The newly created tissue goes through maturation and remodeling during this stage. To strengthen the tissue, collagen fibers are rearranged and cross-linked, and extra scar tissue may be progressively remodeled and removed.^[29]



(4) REMODELING
 Figure:5 Remodeling.

BIOLOGY: The perennial herb needs complete exposure to develop and reproduces via seed. The herb can withstand wind, seaside, heat, humidity, pollution, and drought.^[30]

PHYSICAL CHARACTERISTICS:

Leaves: *Tridax procumbens* has simple, serrated leaves that are grouped in a rosette at the base of the plant. The plant has a distinctive appearance since they are frequently split or lobed.



Figure: 6 leaves.

Flowers: The greatest distinguishing characteristic of *Tridax procumbens* is its blooms. With a yellow blossom in the center surrounded by white, yellow, or pink flowers, they resemble daisies. Typically, the blooms are numerous and tiny, creating branches at the tips of the branches.



Figure: 7 Flowers.

Stem: The plant's prostrate or trailing trunk can grow up to 50 cm in length. The plant can spread and create dense mats because they can take root at the nodes.



Figure: 8 Stem.

Fruits and seeds: Achenes are tiny, cylindrical fruits produced by disc flowers after fertilization. A tuft of white hairs known as pappus covers each achene,

which holds a single seed. The seed is dispersed by the wind with the aid of this fabric.^[31]



Figure:9 Fruits and seeds.

CHEMICAL CONSTITUENTS:

Flavonoids, carotenoids, alkaloids, tannins, and saponins were found in the phytochemical analysis. The adjacent profile demonstrates the plant's high calcium, potassium, and sodium content^[32]. The primary components of *Tridax procumbens* leaves include proteins, fiber, carbs, and calcium oxide. However, the plant has also been found to contain tannin and fumaric acid^[33]. When tested against a glucosidase, oleanolic acid, which was produced in good quantities from *Tridax*, was discovered to be a possible antidiabetic drug^[34]. Alkaloids, flavonoids, carotenoids, fumaric acid, lauric acid, tannins, and other chemical components have all been identified from the plant. The existence of specific chemical compounds (secondary metabolites) that are involved in the creation of various effects on the human body determines the therapeutic potential of plants. Certain compounds are in charge of giving plants their unique characteristics, and they are also in charge of giving plants their various colors^[35]

PROPAGATION:

It cannot be micro propagated using vegetative methods, such as cuttings. Variations result from seed propagation. Techniques for micropropagation-based ex-situ conservation have been developed. Spreading stems and copious seed production are the reasons for its widespread dispersion.^[36]

MEDICINAL USES: Aqueous leaf extract has a cardiovascular impact and dramatically lowers blood pressure and heart rate. The anti-inflammatory properties of lyophilized aqueous leaf extract were similar to those of aspirin and ibuprofen. Hepatoprotective and antisecretory (antidiarrheal) properties are present in whole arial sections. It works against fungi, bacteria, and protozoa. Dead space wounds can be healed with the help of leaf juice. All

forms of bleeding are checked with seeds. The complete aerial part's aqueous extract is employed as an immunomodulator. Even when combined with a mineral basis, dry extract demonstrated antibacterial action.^[37]

Toxicity and Safety Profile of *Tridax procumbens*:

When used in traditional medicine, *Tridax procumbens* is generally safe; most investigations have found no negative effects at typical dosages. Studies on animals show no appreciable alterations in vital organ functions, body weight, or behaviour at therapeutic dosages.^[38]

However, some caution is required at very large doses. Excessive doses of leaf extracts may be cytotoxic in some cell lines and cause liver stress in animal models, as demonstrated by increased liver enzymes, according to laboratory research.^[39]

In summary, *Tridax procumbens* is thought to be safe for frequent usage; nevertheless, too high or extended intake may pose concerns, underscoring the need for cautious dosage and additional safety research.^[40,41]

When taken as prescribed by conventional medicine, *Tridax procumbens* is usually thought to be safe. Normal doses do not significantly alter behaviour, body weight, or the operation of critical organs like the liver, kidneys, or heart, according to research conducted on animals. These investigations' blood tests also showed no appreciable changes in hematological markers, indicating that the plant does not negatively impact the immune system or blood at typical dosage.^[42,43]

Emerging Applications and Potential:

Tridax procumbens is gaining popularity for a number of cutting-edge, contemporary uses in addition to its conventional ones. Researchers are looking at ways to better utilize its beneficial ingredients, which could increase its use in wellness and healthcare.^[44]

1. Nano formulations: When taken directly, several of the plant's bioactive substances, including flavonoids, saponins, and sterols, have poor solubility or stability. Scientists can enhance the bioavailability, stability, and targeted distribution of these chemicals by integrating them into hydrogels, liposomes, or nanoparticles. This strategy may lessen adverse effects, increase therapy efficacy at lower dosages, and enable regulated release of therapeutic chemicals.^[45,46]

2. Cosmeceuticals: *Tridax procumbens*'s antioxidant, skin-protective, and hair-growth-promoting qualities create opportunities for its

application in the cosmetics business. Natural substitutes for synthetic cosmetics, herbal creams, serums, and hair oils made from leaf extracts may promote the health of hair follicles, lessen hair loss, enhance skin texture, and guard against oxidative damage.^[47,48]

Future Directions of *Tridax procumbens*:

Despite *Tridax procumbens*' encouraging pharmacological potential, there are still a number of obstacles to overcome. It is challenging to verify its efficacy in humans because the majority of research is preclinical and clinical trials are still few.^[49,50]

The standardization of extracts is another important concern. Variations in the amounts of active chemicals resulting from different plant sources and extraction techniques can impact consistency and dependability.^[51]

Further molecular research is necessary since the processes underlying its effects—such as wound healing, anti-inflammatory, or antidiabetic actions—are not entirely understood.^[52]

In the future, sophisticated formulations like hydrogels or nano-based delivery methods have intriguing potential to enhance the stability, bioavailability, and therapeutic impact of its bioactive ingredients.^[53,54]

To put it briefly, filling in these gaps could transform *Tridax procumbens* from a conventional treatment into a therapeutic agent with scientific validation.^[55]

II. CONCLUSION:

Tridax procumbens is a promising medicinal plant with significant wound healing potential, supported by both traditional usage and scientific evidence. Its rich phytochemical profile, including flavonoids, alkaloids, tannins, and saponins, contributes to its antimicrobial, antioxidant, and anti-inflammatory properties, which play a crucial role in the wound healing process. The plant has been shown to enhance collagen synthesis, promote angiogenesis, accelerate epithelialization, and improve overall tissue regeneration. In addition to wound healing, it exhibits a wide range of pharmacological activities such as hepatoprotective, antidiabetic, and immunomodulatory effects.

Despite these encouraging findings, most studies are limited to preclinical investigations, and there is a lack of well-designed clinical trials and standardized formulations. Variability in phytochemical composition and extraction methods also poses challenges in ensuring consistency and reproducibility. Therefore, future research should focus on clinical validation, mechanism-based

studies, and the development of advanced drug delivery systems such as nanoformulations and herbal gels. With further scientific validation, *Tridax procumbens* has strong potential to be developed into an effective and safe therapeutic agent for wound management in modern healthcare.

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