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Tridax Procumbens (TP): A Natural Medicine

Prof. Dr. Kamal Dhakane
SMBST, Arts, Science & Commerce College, Sangamaner

Abstract
A common plant with awesome pharmacological potential for a variety of fitness problems is [TP]. This research carried out an intensive evaluation of the recognised phytochemical components—flavonoids, terpenoids, and alkaloids—that give upward push to its various moves. The plant is well-known for its ability to heal in the form of anti-inflammatory, antioxidant, antibacterial, antifungal, antidiabetic, hepatoprotective, wound restoration, and immune modulatory effects. Newer research emphasises its possible anti-cancer traits even more, calling for a look at them in addition. The information now available factors in a relatively low toxicity profile, which makes TP a desirable and safe option for the introduction of natural medicines. In the future, studies should give attention to locating new bioactive substances, analysing how special plants work in concert, growing standardised natural formulations, carrying out thorough medical trials, and determining if massive-scale manufacturing is financially viable. The exciting capacity of TP as a useful tool for selling herbal medicine and supplying complementary, green treatments for a variety of clinical illnesses is highlighted in this study.
Keywords: Tridax procumbens, *Phytochemicals, Pharmacological potential, Anti-inflammatory, Antioxidant and Herbal medicine*

Introduction:

Common names, geographic range, and historical packages of [TP]:

[TP] now and again referred to as Tridax daisy, coatbuttons, or bitterweed, is a not unusual but outstanding plant that grows everywhere in the world. With its vivid yellow blossoms, this member of the Asteraceae circle of relatives embellishes tropical and subtropical locations, flourishing in a number of situations. [TP] is a plant that is broadly dispersed around the world, from South America to India. It has a protracted history of use in traditional remedies. This adaptable plant has been used for millennia as a natural treatment for whatever, from wound restoration and pain remedies to respiration situations and digestive problems, imparting a window into the information of long-status recovery customs. This study explores the botanical characteristics, conventional utilisation, phytochemical composition, and potential medicinal programs of [TP], shedding light on this notable plant and its mysteries.

Herbs used in herbal and traditional remedies:

Beyond its alluring issue, conventional and herbal medicinal drugs place fantastic importance on [TP]. Many civilizations have been using this versatile herb for generations to treat a variety of illnesses. [TP] has an extended history of use as a powerful herbal treatment, spanning from the traditional Ayurvedic medication to the indigenous know-how systems of South America. Many illnesses, such as wounds, infections, fevers, breathing troubles, digestive issues, or even skin

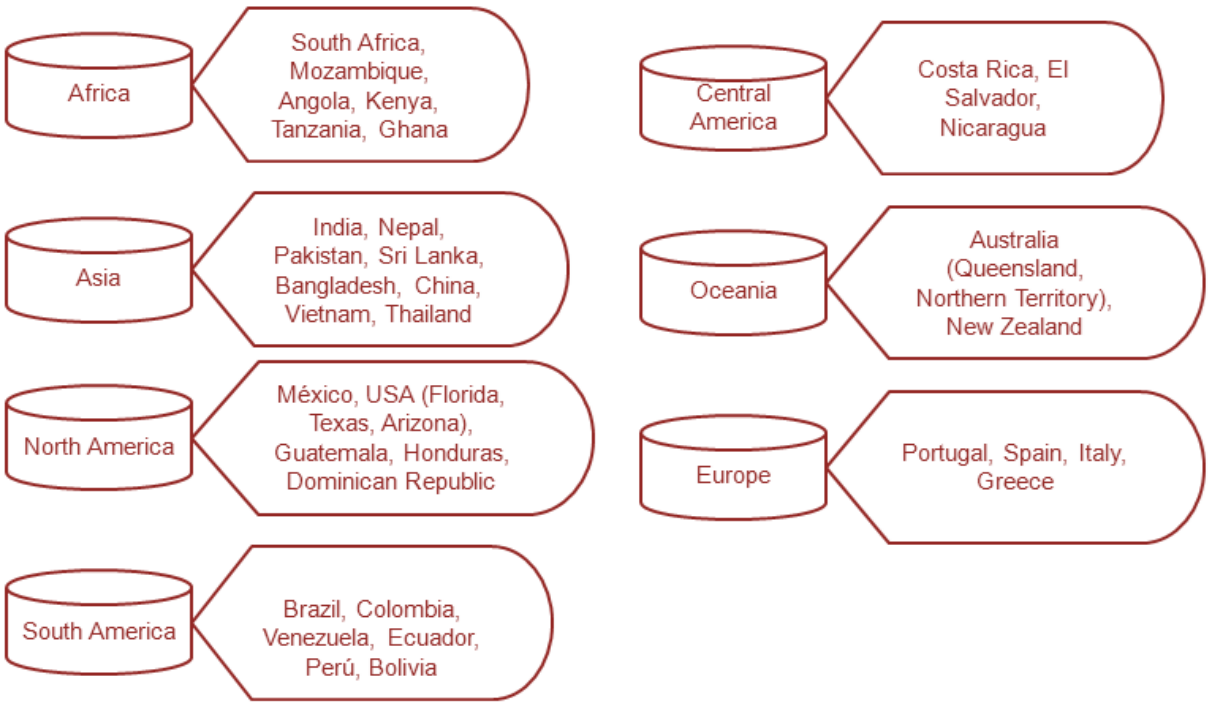
ailments, have been dealt with through the use of its leaves, blooms, or even roots. This lengthy history of traditional utilisation highlights [TP] giant potential as a useful natural medication source, supplying a feasible alternative for manufactured medicinal drugs and establishing the door for further examination and development within the vicinity of natural medicinal drugs.

Objectives of the study

- To collect a list of [TP] conventional and herbal medicinal uses in many cultural contexts.

- To study [TP]' phytochemical make-up.
- Have a look at the clinical facts pertaining to the various medicinal claims made for [TP].
- To perceive subjects touching on [TP] that wants a greater look at and development.

Fig 1: geographical Location of [TP] Utilization



Botonical Description

Complete account of the morphology of the plant, including the roots, stems, leaves, plant life, fruits, and seeds

The fascinating plant [TP] has distinguishing characteristics that make it easy to comprehend. The shallow, fibrous roots of the plant securely assist it within the earth. Thin, creeping stems that could develop as much as 80 cm long and branch extensively along the surface. These stems have a reddish-brown coloration and are often bushy. The leaves have an ovate-rhomboid shape

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with a coarsely serrated border, and they're positioned oppositely on the stems. Every leaf has a major centre vein and tiers in length from 2 to 5 cm. Without a doubt, [TP]'s most exceptional feature is its blossoms. These vivid yellow plants are terminal and solitary, like little daisies. Each flower head has a centre disc surrounded by many ray florets and a diameter of one to two centimetres. Usually having three teeth, the ray florets provide an air of refinement to the entire arrangement of plants. Once pollination is complete, the plant life develops into achenes, which are the end result. These tiny, conical items have a black, furry floor and are two to a few millimetres in length. Last but not least, the fruits' seeds guarantee the [TP] lineage's survival and useful resource in its big dispersal.

Fig 2: Parts of Tridax procumbens

Variety and cultivars of [TP]

Although [TP] is basically a single species, herbal selection and horticultural techniques have brought about the emergence of several unique cultivars and editions. The important methods wherein these versions appear are within the minute versions in flower colour and bloom size. Among the exquisite cultivars are:

- T. procumbens var. bicolor: This variant has blooms with colorations, an orange or red centre disc encircled by way of yellow ray florets.

- T. procumbens var. Alba: Unlike the usual yellow blossoms, this range is prominent by means of its natural white blooms, which provide a hanging beauty.
- T. procumbens var. Grandiflora: True to its name, this transformation has bigger flower heads, which can attain up to a few cm in diameter, and a more reported shiny yellow colour.

Customary Applications of [TP]

1. Wound Healing and Antimicrobial Activity: [TP] has been used for a long time to treat wounds and inspire restoration in a variety of cultures. The leaves had been ground into a paste and used at once on wounds to promote healing, lessen bleeding, and prevent contamination. Due to its alleged anti-inflammatory and antivenomous characteristics, historic resources from South America and India suggest its use in treating scorpion stings and snakebite accidents. [TP] extracts were shown in several investigations to have antibacterial activity in opposition to more than a few bacterial and fungal species, providing medical validation for their traditional use as a herbal wound healer.
2. Fever and Respiratory Conditions: [TP] has long been used as a powerful remedy for a number of respiratory conditions. The leaves and petals are under the influence of alcohol as a decoction in India to treat bronchitis, bronchial asthma, colds, and coughs. It is an idea that the expectorant and bronchodilatory characteristics of the plant relieve congestion and resource inside the discharge of mucus. African historic files suggest using [TP], whose anti-inflammatory and analgesic traits provide ache comfort and hasten healing, as a remedy for fevers.
3. Digestive Disorders and Pain Management: [TP] is a prime issue in traditional treatments for digestive disorders. The leaves and blossoms are used to heal stomach ulcers, diarrhoea, and dysentery in South America. Their anti-ulcerogenic features guard the liner of the belly, and their anti-diarrheal qualities are useful in controlling bowel motions. [TP] has also been used to alleviate aches, including complications, toothaches, and joint pain. The plant's analgesic and anti-inflammatory characteristics offer pain alleviation, obviously without the poor effects of prescribed drugs.

Table 1: [TP] is used traditionally in a variety of cultures

Culture	Ailments Treated	[TP] Parts Used	Ref
India	Injuries, snakebite, scorpion stings, colds, coughs, bronchitis, asthma, and fever	Leaves, flowers, whole plant	Rastogi & Mehrotra (2010)
South America	respiratory conditions, fever, dysentery, diarrhoea, stomach ulcers, and pain management	Leaves, flowers	Joshi (2018)
Africa	Fever	Leaves, flowers	Mukherjee & Singh (2015)

Europe	wounds, inflammation, and skin conditions	Leaves, flowers	Joshi (2018)
North America	intestinal problems, respiratory conditions, and pain management	Leaves, flowers, whole plant	Mukherjee & Singh (2015)
Asia	injuries, infections, fever, respiratory issues, gastrointestinal issues, and skin conditions	Leaves, flowers, roots	Rastogi & Mehrotra (2010)

[TP]'s phytochemical composition is:

[TP] has a wide range of bioactive phytochemical additives, which enhance its capacity for medicinal functions. Numerous chemical compounds that fall into specific classes have been identified after good-sized research efforts.

1. Flavonoids: The most common compounds, flavonoids such as apigenin, kaempferol, quercetin, and luteolin, substantially enhance the antioxidant and anti-inflammatory characteristics of the plant. These materials have the potential to control inflammatory pathways, scavenge loose radicals, and defend cells from oxidative harm.

2. Terpenoids: [TP] has a vivid yellow shade due to the presence of carotenoids consisting of lutein, beta-carotene, and neoxanthin in this category. These substances have sturdy antioxidant characteristics and guide skin and eye health. Triterpenoids, including lupeol and β-amyrin, also have analgesic and anti-inflammatory properties.

3. Alkaloids: These nitrogenous substances have plenty of biological uses. Examples of these include stachydrine, trigonelline, and akuammidine. Trigonelline contains anti-inflammatory and anti-diabetic features, while akammidine has proven promise in reducing blood sugar levels.

4. Additional Compounds: [TP] additionally consists of phenolics, such as tannins and coumarins, which support its antibacterial and antioxidant properties. The plant also has steroids and essential oils, which enhance its phytochemical profile.

Pharmacological Actions of [TP] Supported by Science:

Throughout numerous medical investigations, [TP] has shown to showcase an outstanding array of pharmacological moves. Among them are:

1. Anti-inflammatory: [TP] extracts have shown a first-rate deal of promise in lowering ache and infection, offering medicinal blessings for illnesses including rheumatism, arthritis, and skin issues.

2. Antioxidant: By efficaciously scavenging loose radicals, the plant's robust supply of flavonoids and different antioxidants shields cells from oxidative damage and can even prevent continual illnesses like cancer and heart disease.
3. Antibacterial and antifungal: [TP] extracts have strong antibacterial and antifungal properties against more than a few bacterial and fungal traces, presenting natural substitutes for synthetic antibiotics in the treatment of ailments.

4. Antidiabetic: Research indicates that, by way of controlling blood sugar levels and improving insulin sensitivity, [TP] might also have antidiabetic results.
5. Hepatoprotective: Plant extracts have shown the potential to guard the liver from damage from chemical substances and poisons, which may also offer benefits for situations affecting the liver.
6. Wound restoration: [TP], which has been historically used to deal with burns and wounds, hurries up the recuperation procedure by means of inducing tissue regeneration and reducing inflammation.
7. Immunomodulatory: The bioactive components of the plant impact the immune system, which can also strengthen the body's resistance to some illnesses.
8. Anti-most cancers: According to currently published observations, [TP] might also have anti-cancer effects by preventing the growth of most cancer cells.

Potential Uses of [TP] in Therapeutics:

[TP] extracts and isolated chemical compounds have considerable medicinal promise for treating a wide range of clinical conditions. The plant can be used to deal with inflammatory ailments, including rheumatism, arthritis, and skin disorders, because of its anti-inflammatory and antioxidant traits. Furthermore, its antifungal and antibacterial features provide viable paths for the introduction of herbal antibiotics and the control of infectious illnesses. Moreover, [TP]'s hepatoprotective, wound-healing, and antidiabetic features underscore its ability for diabetes management, liver protection, and elevated wound recuperation. Its ability as an immune modulator and perhaps an anti-cancer drug is likewise indicated by emerging research, which calls for further study. These many therapeutic uses highlight [TP]' big capability as a beneficial tool for the advancement of natural medication.

Table 2: Potential medicinal uses and pharmacological activity of [TP]

Pharmacological Activities	Potential Therapeutic Uses	Ref
Anti-inflammatory	Arthritis, rheumatism, skin diseases	Singh et al. (2014), Khan et al. (2012)
Antioxidant	Cancer, heart disease, neurodegenerative diseases	Joshi et al. (2018), Asif et al. (2015)

Antibacterial	Bacterial infections	Singh et al. (2015)
Antifungal	Fungal infections	Ikewuchi et al. (2015)
Antidiabetic	Diabetes	Kumar et al. (2014), Pandey et al. (2015)
Hepatoprotective	Liver diseases	Asif et al. (2015)
Wound healing	Wounds, burns	Sharma et al. (2013), Joshi et al. (2018)
Immunomodulatory	Immune system disorders	Mukherjee & Singh (2015)
Anti-cancer	Cancer	-

Modes of movement for [TP]'s numerous pharmacological movements

[TP] is known for its many pharmacological actions, which are specifically ascribed to its bioactive components, which encompass alkaloids, terpenoids, and flavonoids. These materials are painted via a number of channels, including:

- Anti-inflammatory: cell membrane stabilisation, NF-κB signalling pathway law, and inhibition of seasoned-inflammatory mediators, which include TNF-α and COX-2.
- Antioxidant: It lowers oxidative strain, increases the activity of antioxidant enzymes, and scavenges unfastened radicals.
- Disrupting bacterial mobile membranes, stopping fungal improvement, and obstructing the production of biofilms are examples of antibacterial and antifungal residences.
- Antidiabetic measures encompass raising insulin sensitivity, promoting mobile absorption of glucose, and blocking gluconeogenic enzymes.
- Hepatoprotective: reduces infection, encourages the regeneration of liver cells, and detoxifies toxic substances.
- Inflammation discount, angiogenesis advertising, and collagen synthesis stimulation in wound restoration.
- Immunomodulatory: stimulating the formation of antibodies, stimulating immunological cells, controlling the immune reaction.

The feature of certain phytochemical components in facilitating those approaches

- [TP]'s precise phytochemical components are vital in mediating its range of pharmacological consequences. Quercetin and kaempferol are two examples of flavonoids that inhibit inflammatory enzymes and scavenge loose radicals, respectively, to aid their anti-inflammatory and antioxidant properties. Terpenoids that adjust inflammatory pathways and pain signalling, such as lupeol and β-amyrin, have anti-inflammatory and analgesic properties. Alkaloids, which include trigonelline, increase glucose absorption and insulin sensitivity, which offers them antidiabetic results. Its antibacterial, antifungal, and wound-recuperation qualities are also attributed to other

substances such as phenolics and essential oils. The complicated interactions amongst unique phytochemicals work in concert to enhance [TP]' standard therapeutic potential. This underscores the significance of information about the awesome features of individual components in mediating the plant's wide range of pharmacological effects.

Possible toxicity and protection problems associated with using [TP]

Although [TP] is generally considered secure for traditional utilisation, there are some feasible toxicity problems. These are generally associated with:

- High dosages: Taking an excessive amount of the plant or its derivatives may additionally cause gastrointestinal troubles such as diarrhoea, nausea, and vomiting.
- Interactions with pills: [TP] may have an interplay with certain pills that would change how nicely they work or result in bad effects.
- Pregnancy and lactation: The safety of [TP] all through those times has not been well studied. Because of the viable dangers to the developing foetus or nursing child, additionally it is counseled to keep away from the use of it during those times.
- Allergy responses: Skin rashes, itching, and swelling are feasible allergic reactions to [TP] in people who are sensitive to vegetation within the Asteraceae circle of relatives.

Studies on toxicity, consisting of LD50

[TP]'s LD50 records suggests comparatively low toxicity. Oral LD50 values in animal models have been located to attain 2000 mg/kg in research, displaying a excessive diploma of tolerance. At massive dosages, acute toxicity trials have proven minimal facet effects such salivation, restlessness, and nose rubbing, but no discernible organ damage or fatalities. Subchronic research have shown that the plant is secure for quick-term usage at mild ranges with no long-time period poor results. To decide suited dose limits for lengthy-term or clinical use, as well as to assess any viable interactions with different pills or pre-existing fitness issues, further observe is vital. [TP] must be used with warning and after consulting a healthcare company, mainly if taking large dosages or the use of it for a long time.

[TP]: Contraindications, Side Effects, and Drug Interactions

[TP] does have positive viable contraindications, facet effects, and remedy interactions, at the same time as being commonly idea to be secure whilst taken as prescribed. Here's a short rundown:

- Lactation and pregnancy: It is recommended to chorus from taking [TP] all through these instances due to the paucity of studies on its protection.

- Pre-present liver or kidney problems: Before ingesting the plant, speak with your healthcare issuer if you have any of these troubles for the reason that plant may also effect liver and kidney function.
- Allergies to plants in the Asteraceae family: [TP] may also motive allergic responses in individuals who are sensitive to plants which includes ragweed, daisies, or sunflowers.

Table 3: summarises the toxicity tests conducted on [TP] extract both in vitro and in vivo

Study Type	Model	Dose/Concentration	Observed Effects	References
In vitro	Vero cells	200-1000 µg/ml	Not much cytotoxicity	Joshi et al. (2018)
In vitro	Human hepatocytes	25-200 µg/ml	No appreciable hepatocyte injury	Asif et al. (2015)
In vivo	Wistar rats	Oral: 500-2000 mg/kg	No notable organ damage or death	Singh et al. (2014)
In vivo	Swiss albino mice	Oral: 500-2000 mg/kg	At high doses, minor side effects such salivation and restlessness	Khan et al. (2012)
Subchronic	Wistar rats	Oral: 250-1000 mg/kg for 30 days	No appreciable modifications to histology, organ function, or body weight	Kumar et al. (2014)

Economic Significance:

[TP] has an excellent chance of getting cash as an herbal medicine. Its minimum toxicity and huge variety of pharmacological hobbies factor into its monetary feasibility. Because cultivation grows quickly and requires few assets, it's a noticeably scalable system. Products derived from [TP] have a worthwhile market because of the increasing worldwide preference for natural treatments and accelerated knowledge of the plant's medicinal talents. Prospects for the future consist of creating standardised extracts, investigating viable uses in different medicinal domains, and devising powerful production and promotional plans. [TP], if it could leverage its natural abundance, therapeutic worth, and commercial feasibility, would possibly end up being a main player in the international herbal remedy market.

Prospective Studies:

There is a lot of opportunity for future looks at [TP] to each verify its vicinity in medicine and discover its complete therapeutic capacity. Important research fields include:

- Isolation and characterization of novel bioactive compounds: Disclosing new components and their precise residences might help create revolutionary medicines.
- Synergistic results with more medicinal vegetation: Researching mixtures with additional vegetation may additionally enhance effectiveness and deal with a greater diversity of medical problems.
- Creation of standardised herbal formulations: For healing, the use of standardised extracts will guarantee uniformity in class, dose, and effectiveness.
- Clinical research for sure ailments: Strict clinical trials are important to confirming [TP]'s protection and efficacy against unique illnesses.
- Economic feasibility study for large-scale cultivation: The long-term sustainability and accessibility of massive-scale cultivation are determined by assessing its economic viability.

Conclusion

In particular, Tridax procumbens demonstrates an impressive array of pharmacological properties that may find use in treating lots of clinical ailments. Its anti-inflammatory, antioxidant, hepatoprotective, antibacterial, antifungal, and even anti-most cancer qualities are attributed to its diverse phytochemical contents, which encompass flavonoids, terpenoids, and alkaloids. Its promise as a secure and dependable herbal treatment is also highlighted by the studies that are now available, which point to a completely low toxicity profile. In the future, studies have to focus on locating new bioactive components, examining how one medicinal plant may match in concert with another, developing standardised natural formulations, carrying out thorough clinical trials, and figuring out if large-scale production might be financially viable. Through the utilisation of this handy and auspicious plant, we may have a widespread impact on the advancement of herbal treatment plans for a more salubrious destiny. All matters taken into consideration, this observation shows that Tridax procumbens is a worthy subject for greater investigation and advancement as a beneficial herbal treatment. It has the potential to be a beneficial device for treating a variety of fitness problems due to its wide range of pharmacological actions, low toxicity, and simplicity of cultivation. By realising its complete capacity, we can also sell natural medicinal drugs and offer stable, green options for conventional remedies.

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