



# UNVEILING THE THERAPEUTIC PROMISE OF TRIDAX PROCUMBENS: A COMPREHENSIVE REVIEW ON ITS MEDICINAL PROPERTIES AND ANTI-CANCER POTENTIAL IN INDIAN TRADITIONAL MEDICINE

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**Abstract:** A review explores the medicinal potential of indigenous plants in Indian traditional medicine. *Tridax procumbens* is a very useful species of plant that produces secondary metabolites described to have many medicinal uses including anti-anemic, anti-inflammatory, antidiabetic, anesthetic and anti-cancer. This study explores the medicinal properties, biological activities, and phytochemical components of *T. procumbens*, a promising species from the Asteraceae family originating in central and South America. The research involves in-vitro cytotoxic assays on A549 human lung carcinoma cell lines, revealing significant inhibition. Therefore, more clinical studies are had to be carried out to provide further clinical viability. The review emphasizes the need for further research to fully understand the therapeutic potential of *T. procumbens* in anti-cancer activity on lungs, positioning it as a valuable ethnobotanical resource for preventive treatments, particularly in its native region. <sup>[1,2]</sup>

**Index Terms - *Tridax procumbens*, Anti-cancer, Luteolin, Lung cancer**

## I. INTRODUCTION

This study explores the potential anti-cancer properties of *Tridax procumbens*, a tropical plant with a rich history of medicinal use. With over 500,000 plant species sustaining life on earth, herbal medicine, rooted in ancient civilizations, is experiencing a global resurgence. In India, where ethnobotanical knowledge thrives, *Tridax procumbens* is notable for its traditional uses and scientifically proven medicinal properties. The research focuses on the compound Luteolin found in plant, employing virtual screening to assess its pharmacological properties and structural stability. This investigation contributes to ongoing efforts in identifying natural sources for novel therapeutic agents, emphasizing the significance of *Tridax procumbens* in potential anti-cancer drug development. <sup>[1,2,3]</sup>

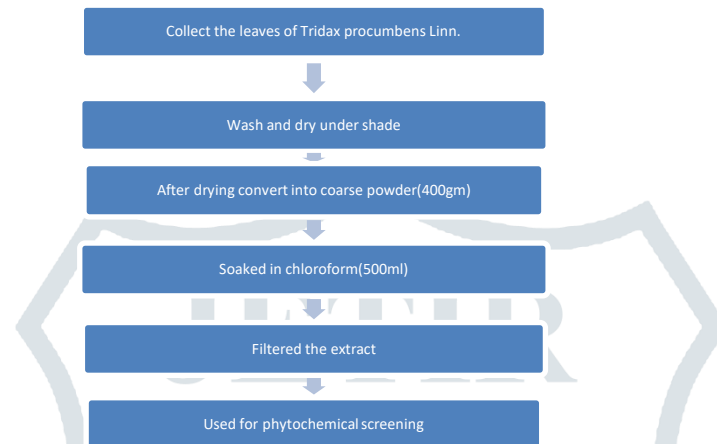
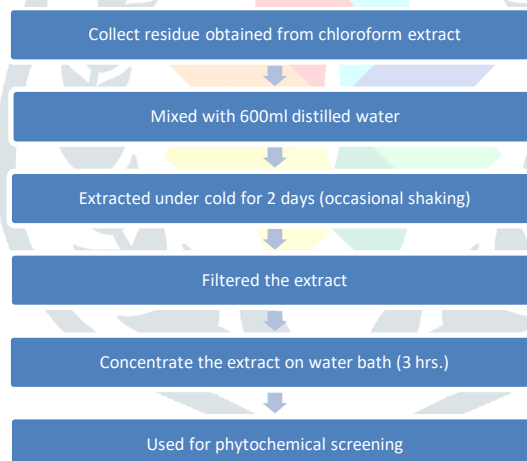
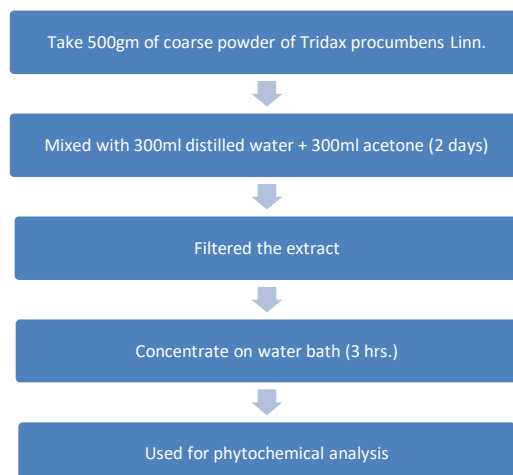


**Experimental:  
Plant Material**

The leaves of *Tridax procumbens* Linn. Were collected from the local garden and the plant was taxonomically authenticated at the Department of Botany Research Centre Padmashri Vikhe Patil college of arts, science and commerce Pravaranagar-413713

**Preparation of extract:**

The entire plant powder underwent extraction using a Soxhlet apparatus, where it was treated with 95% ethanol at 50<sup>0</sup> C. extraction was carried out for 72 hours. The extract was filtered, and the filtrate was concentrated to a dry mass. The yield was found to be 6% W/V. the extract was stored in desiccators at room temperature until analysis.

**1. Chloroform extract:****2. Chloroform-water extract:****3. Acetone-water extract:**

Various extraction of *Tridax procumbens* was studied and further proceed for different phytochemical analysis. [3,4,5]

**Phytochemical analysis:**

The several chemical tests were performed on extract for identification of phytochemicals present in the *Tridax procumbens*. The phytochemical tests were done by achieving standard procedure. By several studies it was concluded that the main responsible chemical constituent is flavonoids (Luteolin) for the anti-cancer activity. So chemical tests for flavonoids are performed.

Sr. No	Phytochemicals	A.W. E	C.E.
1	Tannin		
	Lead acetate	+	-
	Ferric chloride	+	-
2	Saponin	+	+
3	Flavonoids		
	Alkaline reagent test		
	NH <sub>4</sub> OH	+	+
	Mg turning test	+	+
4	Zn test	+	+
	Alkaloids		
	Wagner test	+	+
	Hager test	+	+

From the above-mentioned chemical tests, we can conclude that the chemical constituents present in the *Tridax procumbens* are helpful for recovering cancer tumors. <sup>[6,7,8]</sup>

**Tridax procumbens as potential inhibitor:**

*Tridax procumbens* is rich in phytochemicals among them luteolin is a flavonoid possess anti-cancer properties. There is various study has done on anti-cancer properties of luteolin. The anticancer property of luteolin found against gastric cancer, breast cancer, prostate cancer, brain tumor, etc. so there is tremendous scope is present in anticancer agent.

Luteolin is a part of vitamin B family. It easily presents in several food supplements like broccoli, apple skin, carrots, cabbages, onion leaves, etc.

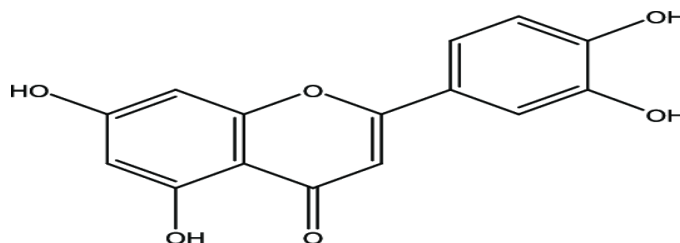
Luteolin, a phenolic phytochemical belonging to the flavone class of flavonoids, exhibits significant therapeutic potential in the management of carcinogenesis. Its efficacy lies in its ability to induce apoptosis, activate cell cycle arrest, mitigate angiogenesis, metastasis, and cell proliferation, among other mechanisms.

One of the notable aspects of luteolins anticancer effects is its ability to modulate multifaceted oncological pathways that contribute to tumorigenesis. For instance, in glioblastoma cells, luteolin induces mitochondrial dysfunction and activates the endoplasmic reticulum stress response, leading to the generation of intracellular reactive oxygen species (ROS). This process further triggers the expression of stress-related proteins through the phosphorylation of PERK, ATF4, Eif2a, and cleaved-caspase.

Moreover, luteolin has been observed to reverse epithelial-to-mesenchymal transition (EMT), a process associated with cancer cell progression and metastasis. It achieves this by diminishing cytoskeletal changes and upregulating the expression of E-cadherin and vimentin expression.

Additionally, luteolin possesses neuroprotective properties, which are beneficial in improving spinal damage and brain trauma caused by certain factors. Its ability to sensitize cancer cells enhances the efficacy of chemotherapy by downregulating key cellular pathways such as nuclear factor kappa B (NF-κB), phosphatidylinositol 3-kinase (PI3K)/Akt, and X-linked inhibitor of apoptosis protein (XIAP).

Overall, the robust anticancer profile of luteolin makes it an attractive candidate for the development of potential anticancer drugs. Its multifaceted modes of action and ability to target various oncological pathways make it a promising avenue for further research and development in the fight against cancer.



**Chemical structure of luteolin**

Luteolin and quercetin were isolated with the flavonoid procumbenetin from *Tridax procumbens* having anticancer activity. Lutein, glucoluteolin, and isoquercetin are found in the flowers of *T. procumbens*. Luteolin has been shown strong inhibition against tumor proliferation by suppressing angiogenesis. In vitro studies specify that luteolin has activity against different cancer cell line including human lung squamous carcinoma and uterine cancer. <sup>[9,10]</sup>

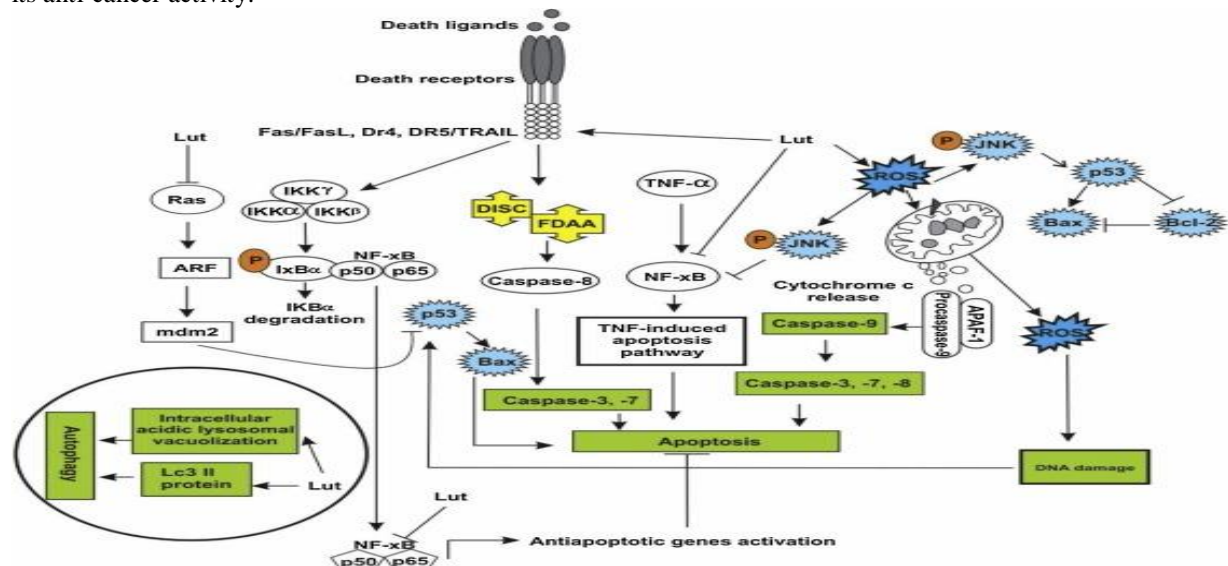
**Structure activity relationship of luteolin:**

Luteolin, a natural flavonoid, exhibits promising anti-cancer properties with mechanism targeting various stages of carcinogenesis. Its structural features, including the ortho-dihydroxy structure in the B-ring and the 2,3-double bond in conjugation with the 4-oxo function of the C-ring, contribute to its antioxidant capacity. Luteolin forms chelates with metal ions without undergoing oxidation, further enhancing its therapeutic potential.

Studies reveal that luteolin effectively suppresses the proliferation of tumor cells both in vitro and in vivo, with IC50 values ranging from 3 to 50 uM. It demonstrates inhibitory effects on cell transformation, metastasis, invasion, and angiogenesis, mediated through multiple mechanisms. These mechanisms include the suppression of kinases, regulation of the cell cycle, induction of apoptotic cell death, and reduction of transcription factors.

Luteolin induces apoptotic cell death in cancer cells through mechanisms involving DNA damage, redox regulation, and modulation of protein kinases. Notably, it includes G1 phase cell cycle arrest in various human cancer cell lines, such as gastric, prostate, colorectal, and melanoma, by inhibiting CDK2 activity.

The review emphasizes the significant chemo-preventive and therapeutic potential of luteolin against different types of cancer, highlighting its diverse mechanisms of action. Fig. illustrates various signaling pathways affected by luteolin in its anti-cancer activity. [11,12]



### Luteolin with different combination:

The synergistic effects of luteolin with various natural and synthetic drugs in cancer treatment have been extensively studied, demonstrating promising outcomes:

- Luteolin combined with oxaliplatin led to decreased p21 protein expression in p53+/+ HCT116 cells, showing synergistic effects compared to either drug alone.
- Luteolin combined with hesperidin downregulated miR-16 expression in breast cancer cells (MCF-7).
- Luteolin-complexed nanoparticles decreased Nrf2 mRNA expression more effectively than luteolin alone.
- Combination of luteolin with sulforaphane reduced expression of proteins in the NF-κB pathway and STAT3 activation.
- Luteolin combined with celecoxib or quercetin enhanced antiproliferative effects in breast cancer cells by various mechanisms.
- Combination of luteolin and oxaliplatin suppressed proliferation of gastric cancer cells through modulation of the Cyt C/ caspase pathway.
- Luteolin and lapatinib synergistically inhibited ERBB 1, ERBB 2, mRNA expression, and Akt and ERK1/2 phosphorylation in breast cancer cells.
- Combination of luteolin and silibinin reduced migration and invasion of glioblastoma cells and induced apoptosis.

The above information suggests that combining luteolin with conventional chemotherapeutics could enhance efficacy while potentially reduced adverse effects. Further clinical trials are needed to validate these synergistic effects and explore their clinical utility. [12]

### Pharmacological properties:

As *Tridax procumbens* is a great source of various secondary metabolites they further exhibit diverse pharmacological properties, including potential benefits in anemia prevention, hepatoprotection, immune enhancer, antibacterial, antifungal, and antiviral activities.

#### I. Anticancer activity:

*Tridax procumbens* showing potent cytotoxic activity against malignant tumor cell. According to various studies it was found that aqueous extract of *T. procumbens* was having less cytotoxic activity while the acetone extract having potent activity against cancer cells. The viability was tested by performing the MTT assay.

T. procumbens showing significant inhibition against the tumor in lung due to the formation of new blood vessels in response to monoterpenes.

- II. **Antioxidant activity:**  
Tridax procumbens possesses antioxidant properties due to the presence of various phytochemicals such as flavonoids, phenolics, and tannins. These compounds help in scavenging free radicals and reducing oxidative stress in the body.
- III. **Anti-inflammatory activity:**  
Extracts from Tridax procumbens have been reported to exhibit anti-inflammatory effects, which can help alleviate inflammation-related conditions such as arthritis, gastritis, and skin inflammation.
- IV. **Antimicrobial activity:**  
Tridax procumbens extracts have shown antimicrobial activity against a wide range of bacteria, fungi, and viruses. This property can be useful in the treatment of various infectious diseases.
- V. **Wound healing:**  
Tridax procumbens extracts have been traditionally used for wound healing purposes. Studies have shown that the plant extracts possess wound healing properties, which can accelerate the process of wound closure and tissue repair.
- VI. **Antidiabetic activity:**  
Some research suggests that Tridax procumbens extracts may have potential antidiabetic effects by reducing blood glucose levels. This could be beneficial for managing diabetes and its associated complications.
- VII. **Anti-ulcer activity:**  
Tridax procumbens extracts have been investigated for their potential to protect against gastric ulcers. Studies suggest that the plant extracts may help in reducing gastric acid secretion and preventing mucosal damage in the stomach.
- VIII. **Hepatoprotective activity:**  
Tridax procumbens extracts have been shown to possess hepatoprotective properties, which can help to protect the liver from damage caused by toxins, drugs, or diseases. [13,14,15,16,17]

#### Role of silver nanoparticles using the Tridax procumbens plant in cancer treatment:

Green synthesis refers to the environmentally friendly approach of synthesizing nanoparticles using natural sources like plant extracts. It is considered advantageous over conventional methods due to its eco-friendliness, cost-effectiveness, and scalability. Numerous studies have demonstrated the potential of green synthesis for producing silver nanoparticles with various properties.

Tridax procumbens, commonly known as coat buttons, is a medicinal plant with a history of use in traditional medicine for various ailments. The plant contains bioactive compounds such as flavonoids, alkaloids, terpenoids and phenolic compounds, which possess antioxidant, anti-inflammatory and anticancer properties. The aqueous extract of Tridax procumbens serves as a reducing and stabilizing agent in the synthesis of silver nanoparticles.

Silver nanoparticles synthesized using Tridax procumbens leaf extract have shown promising anticancer activity in preclinical studies. These nanoparticles exhibit cytotoxic effects against cancer cells through various mechanisms such as induction of apoptosis, inhibition of cell proliferation, and disruption of cancer cell metabolism. Additionally, silver nanoparticles have been explored for their potential in targeted drug delivery, imaging, and photothermal therapy, further enhancing their utility in cancer treatment. [18,19]

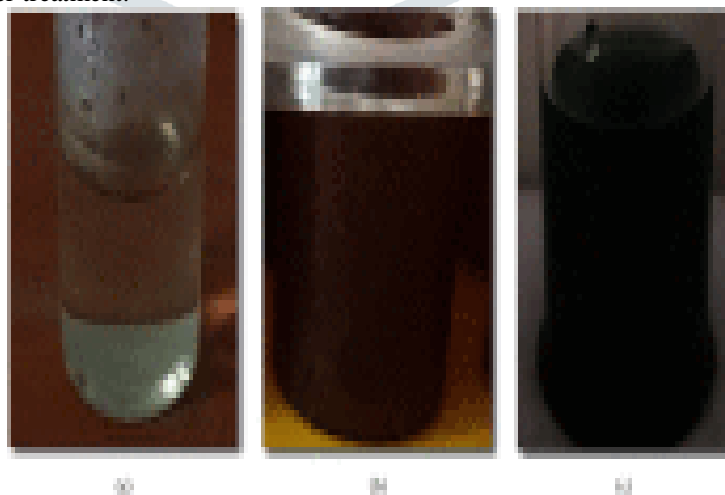


Fig. Synthesis of silver nanoparticles: a) control b) silver nanoparticles (TNP) c) aqueous leaf extract

#### conclusion:

The review paper extensively explores the medicinal potential of Tridax procumbens, shedding light on its traditional uses in Indian medicine and its scientifically proven pharmacological properties. The focus primarily lies on its anti-cancer potential, attributed to the presence of secondary metabolites, particularly luteolin, a flavonoid with significant therapeutic implications.

The experiment section provides insight into the extraction and phytochemical analysis of Tridax procumbens, emphasizing the presence of flavonoids like luteolin, which have been linked to anti-cancer activities. Further, the

structural features and mechanisms of action of luteolin are elucidated, showcasing its ability to target various stages of carcinogenesis and modulate oncological pathways.

Additionally, the review highlights the synergistic effects of luteolin with other natural and synthetic drugs, suggesting promising outcomes in cancer treatment. Pharmacological properties beyond anti-cancer activity are also discussed, including hepatoprotection, immune enhancement, and antibacterial activities, further underscoring the potential of *Tridax procumbens* in holistic healthcare.

Moreover, the role of silver nanoparticles synthesized using *Tridax procumbens* leaf extract in cancer treatment is explored, demonstrating its cytotoxic effects on cancer cells and potential applications in targeted drug delivery and therapy.

Overall, the review underscores the need for further clinical studies to fully comprehend the therapeutic potential of *Tridax procumbens*, particularly in anti-cancer activity, positioning it as a valuable ethnobotanical resource for preventive treatments, especially within its native region. This comprehensive exploration paves the way for future research and development in utilizing natural sources like *Tridax procumbens* for novel therapeutic interventions in the fight against cancer. <sup>[20]</sup>

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