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Review Article

# Pharmacoepidemiology of yellow trumpet flower

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ABSTRACT

Because synthetic pharmaceuticals may produce various side effects and unfavorable consequences, the use of natural plants in therapy is currently more common than synthetic goods. Tecoma stans is a plant found in most tropical countries. This plant belongs to the Bignoniaceae family and is already used in ancient medicine in various countries such as India and Pakistan. This plant has a large number of active chemical ingredients and has pharmacological effects. Many researchers have explored pharmacological screening, and ongoing research is being conducted in that plant. The goal of this study was to update the plant's research collections for pharmacological screening. The review focuses on several researches, such as pharmacognostical studies and in-vitro and in-vivo screening of numorous Tecoma stans components. The various parts of the plants were concluded to have various pharmacological actions such as anti-inflammatory, analgesic, anticancer cardioprotective effect, genotoxic, cytotoxicity, wound healing, antihyperglycemic, protect CNS, gastric ulcer healing, antiproliferative, antioxidant, anti-microbial, haemolytic activity, anti-lipoxygenase, and acetyl-cholinesterase inhibitory activities. This review was then used to guide future study on this plant. A member of the trumpet vine family, Tecoma stans, has been documented for a variety of pharmacological properties. The current research focuses on the neuropharmacological activities of several Tecoma stans extracts. The CNS depressive action was addressed first, followed by the analgesic activity, and then the impact of various extracts on Albino mice was examined.



## 1. Introduction

Natural components have been used for medicinal purposes since human evolution, and for a long time, plant, mineral, and animal products have been the major foundations of medications. Alternative remedies and the therapeutic use of natural items, especially those originating from plant life, have gotten a lot of attention in recent years. This interest in plant-based drugs stems from a variety of factors, including the fact that conventional medicine can be ineffective, and that offensive or improper use of synthetic drugs can result in side effects and other complications. The Indian subcontinent has experienced one of the most ancient evolutions, and the emergence of various traditional healthcare systems.

## 2. Tecoma Stans (Yellow trumpet flower)

Plants have been utilised as a source of medicine for many decades and continue to be a viable source of medication

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for a variety of pathological disorders. Tecoma stans is a traditional herb with several pharmacological properties. Tecoma stans is a member of the Bignoniaceae family.[1] It is a perennial shrub that grows to a height of 5-8m and is used as an attractive plant due to its vivid yellow trumpet-shaped blooms. The bloom has five circular lobes. The plant's bark is light brown to grey in colour.

The leaves are compound and odd pinnate, with two to five pairs of leaflets and a solitary terminal leaflet. They're a dark green colour. The calyx is green and is 5-7mm in length. Tecoma stans fruits may grow to be up to 20cm long and contain many airborne seeds. When the seeds are young, they are green, but as they mature, they become brown.[2] Hummingbirds and bees are often responsible for pollinating these blooms.[3] This plant thrives in hotter climates because to its drought resistance.

As a result, they are usually found in subtropical and tropical areas. The classifications Tecoma is a taxonomic form of the Bignoniaceae family, which comprises 120 additional genera and 800 distinct species of trees and shrubs, most of which grow as climbing trees and very rarely as herbs. It is endemic to Florida, the West Indies, and Mexico in South America. It is often offered in St. Louis area nurseries as a vessel plant for patios, alongside Bouganvillea and Mandevilla. It is found across India since it requires humid weather to develop.[2]

Tecoma stans is also known by a variety of colloquial names. In Hindi, it is known as Piliya or Pilakaner. The English term for yellow bells is the most frequent. In Kannada, it is known as Koranekelar, while in Tamil, it is known as Sonnapatti. Pachagotla is the name in Telegu and Chandaprabha is the name in Bengali. In Marathi, Tecoma stans is known as Ghantiful.[3]

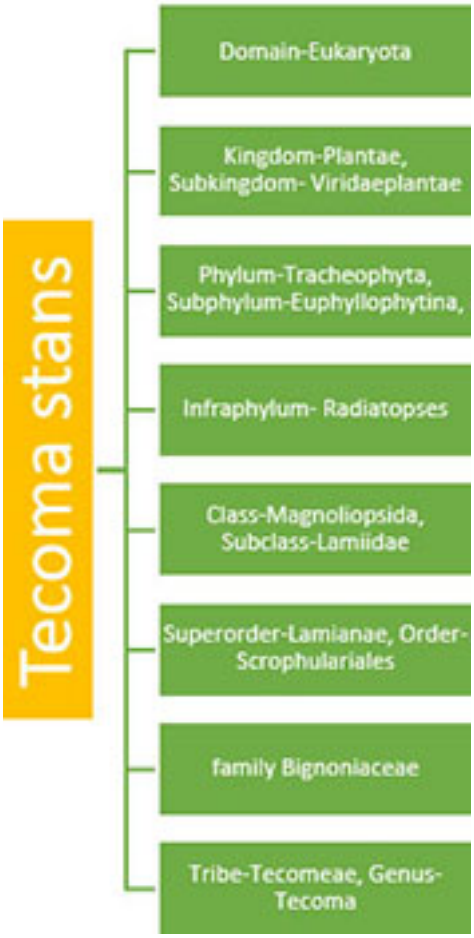


**Fig. 1:** Taxonomy of Tecoma stans

### *2.1. Chemical components*

Plant components such as the leaf, bark, fruit, root, and flowers contain a variety of chemical compounds. These ingredients are determined using several phytochemical research. Different solvents are used to extract the active chemical components. The presence of alkaloids, phenols, terpenoids, glycosides, flavonoids,[4] saponins,[5] carbohydrates,[6] amino acids,[7] phytosterols,[8] monoterpenes,[9] triterpenes, fixed oils,[10] fats, gums,[11] mucilage, resins,[12] volatile oils, quinines, and tannins is demonstrated by phytochemical tests.[13]

Among the sugars are glucose, xylose, fructose, and sucrose. Similarly, triterpenoids include ursolic and oleanolic acids, as well as -amyrine.[7,14] The plant contains phenolic chemicals such as chlorogenic,[15] caffeic,[12] vanillic, o-cumaric, and sinapicn acids.[16] Tecoma stans also contains anthrallic acid, which is an essential chemical ingredient.[10] Tecomine and tecostamine are the alkaloids found. 4-noractinidine is another alkaloid. These alkaloids are often found in the leaves.[17] Flavaoids,

**Fig. 2:** Yellow trumpet shaped flower of Tecoma stans

Chryseriol, Luteolin, indole oxygenase,[7] Boschniakine, 5-hydroxyskitanthine,[5] 4- noractinidine, and 4-norskytanthine are some of the various chemical compounds that may be isolated from leaves.[18] Carotene may be found in the flowers. The blooms may also be used to extract various flavonones. (7,8-dihydroxy-4,6-dimethoxy flavones and Kaempeferol are two examples.)[2] Seeds contain fatty acids and lipids. Stearic acid, palmitic acid, octadecenoic acid,[3] octadecadieonic acid, and octadecatetraonic acid are all ingredients.[17] The presence of monoterpenoids and tecomanine is shown in ethanolic preparations of flowers.[5]

### 2.2. Pharmacological actions of Tecoma Stans

Tecoma stans has been utilised as a medicine since antiquity. It has a wide range of medical applications. It was recognised to treat diabetes, and this is still true today. Tecoma stans include a variety of chemical components with varying pharmacological effects. Numerous investigations have been conducted to demonstrate the pharmacological actions of Tecoma stans.

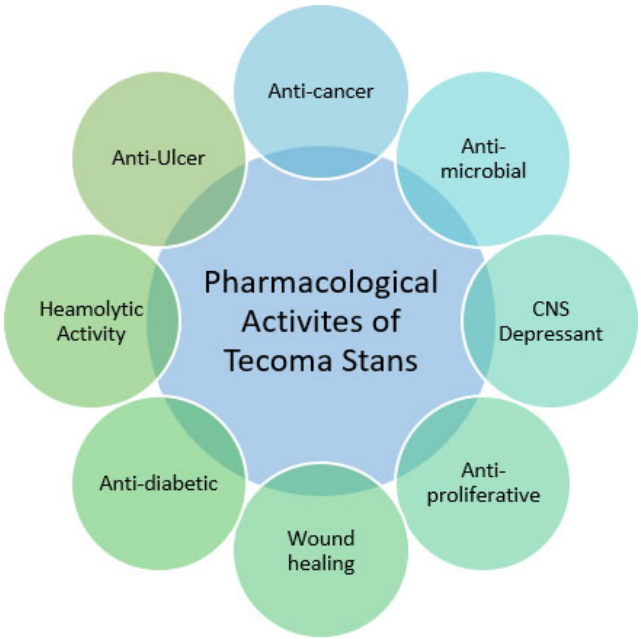


**Fig. 3:** Pharmacological activities of Tecoma stans

### 2.3. Anticancer properties

Cancer is a terrible disease that has over 100 distinct varieties and is characterised by uneven cell growth, necessitating a multifaceted strategy for treatment, management, and prevention. It is also the world's second biggest cause of mortality. Breast cancer is considered as the long-term illnesses that females (32.1 percent) may encounter during their lives, and it is the most often diagnosed malignancy in them. The MTT assay is used to test the antiproliferative activity of several Tecoma stans components in breast cancer-MCF-7 cell lines. The bark, stem, root, and flower extracts all had considerable anti-proliferative activity on the cell lines (MCF-7), but the extract stem bark of Tecoma stans had the most potent effect. The flavanoids found in Tecoma stans have anticancer properties. It has been shown that consuming a lot of flavonoids reduces your risks of getting cancer.[3] Flavonoids work by reducing tumour start, development, and progression. Various studies reveal the involvement of various mechanisms of action.[19] Carcinogen inactivation, cell cycle arrest, induction of apoptosis, antiproliferation and differentiation, suppression of angiogenesis, and reversal of multidrug resistance are some of the modes of action.[4]

### 2.4. Anti-inflammatory properties

Tecoma stans extracts in methanol, ethanol, and water have anti-inflammatory properties. Heat-induced albumin denaturation and RBC membrane stability are responsible for this action. The DPPH test may also be used to assess anti-inflammatory activity.[20,21] Inflammation occurs as a consequence of the tissue's response to infection, external substances, or irritation. The inflammation process is critical in wound healing. Inflammatory responses include many processes, including the production of bradykinin, histamine, and prostaglandins. Anti-inflammatory medications are used to prevent inflammation.

These anti-inflammatory medications are tested using in vivo animal models, and the drug's activity is determined by comparing it to the standard and control groups.[3]

### 2.5. Antimicrobial potency

Tecoma stans alcoholic and aqueous extracts have antimicrobial action.[22] The antimicrobial action of stem and bark extracts is greater than that of leaf extracts.[23] Tecoma stans' antimicrobial action is mostly attributed to flavonoids. The disc diffusion technique is mostly used to assess antimicrobial activity. Many of the world's health issues are caused by microbial illnesses. The use of synthetic antimicrobial medications and antibiotics may have certain negative side effects, thus employing plant sources as antimicrobial agents is vital for microorganism healing. Plant extracts are subjected to antimicrobial assays using the disc diffusion method, agar medium, and minimum inhibitory concentrations, among other things. In this method, positive and negative strains of organisms and fungal strains are used to inhibit microbial growth, which is inhibited by the incorporation of drugs. The zone of inhibition was calculated and compared with the standard, and the antimicrobial activity was determined.

### 2.6. Wound healing activity

The methanolic extract of Tecoma stans leaf and bark significantly reduced wound area.[24] This action is linked to the presence of phytoconstituents such as phytosterols, saponins, triterpenes, glycosides, flavonoids, and tannins, which may have a synergistic impact on wound healing.[2,3] Wound healing refers to the processes of wound tissue development and regeneration. The goal of wound repair is to enhance wound healing in the shortest amount of time feasible while causing the patient the least amount of pain, discomfort, and scarring. In traditional medicine, several medicinal plants are used to treat wounds. The in vivo investigation of wound healing using different wound animal models and comparison with the standard group and control.

### 2.7. The haemolytic activity

Drop diffusion, the Minimum Inhibitory Concentration technique, and the Haemolytic test are used to measure haemolytic activity. The zone of inhibition determines the outcome.[3] Hemolysis is the process by which the cytoplasmic membrane is damaged, resulting in cell lysis and death. The following approach is used to assess hemolytic activity. Human blood of various groups (A, B, and O) is taken from healthy volunteers in tubes containing the anticoagulant heparin. The hRBCs were gathered after centrifugation at 3,000 rpm for three minutes. The cells are rinsed with PBS solution again and again until the supernatant is colourless. In a microwell plate, the hemolytic test was carried out.

Each well is filled with PBS. And ABCs were added to the wells. In the appropriate wells, serially diluted peptide solutions are introduced. The hRBCs serve as a negative control, whereas the hRBCs in Triton serve as a positive control. the well's button creation is noticed after 1 hour of incubation.

### 2.8. Antioxidant activity

Tecoma stans aerial component has antioxidant action.[3] Antioxidant qualities are provided by tannins and flavonoids.[25,26] The DPPH test and the nitric acid assay may both be performed using ethanolic and methanolic extracts.[20] Pathological cell metabolism generates more than one unpaired electrons, resulting in free radicals. The most prevalent free radicals are hydroxyl, superoxide, and peroxyl radicals. These are the radicals created by the oxidation process in the system. Antioxidants protect the human body against reactive oxygen species. The discovery of novel medical drugs with efficient prevention and therapy functions against many illnesses has resulted from the spread of diverse bioactive chemicals from plants. The antioxidant action of the plant is assessed using the FRAP test, and the APTS and DPPH radical assays. These tests are then compared to common antioxidant medications like vitamin E, vitamin C, and so on.[3]

### 2.9. Neuropharmacology of Tecoma Stans

Tecoma stans' chemical compounds have a range of effects on the CNS. The main impact is CNS depressive action, which is shown by three key constituents: triterpenoids, phenols, and flavanoids. Tecoma stans methanolic extract, in particular, has an influence on CNS activity. Tecoma stans heartwood methanol extracts alter broad behavioural characteristics. The extract elucidates a depressive effect and reduces consciousness. The methanolic extract also has an impact on spontaneous sound, activity, and touch responses.[20] There was some depression associated with attentiveness and awareness. The action of varied extract doses on the CNS results in a considerable rise in the hypnotic effect. The methanol extract of tecoma stans heartwood may react with the benzodiazepine receptor, which is located next to the GABA receptor. Similarly, Tecoma stans alcoholic leaf extract has potent anti-nociceptive action. When compared to the alcoholic extract, the alcoholic extract exhibits greater antinociceptive efficacy. Hot plate, acetic acid induced writhing, and formalin induced paw licking procedures may be used to assess antinociceptive activity The central analgesic action is often evaluated on mice or rats, while large animals such as monkeys may be used in select cases. Some of the methods used to assess central analgesic activity include Haffner's tail clip method in mice, Tail flick or other radiant heat methods, Hot plate methods in mice or rats, Electrical stimulation[grid shock, stimulation of tooth pulp or tail], Monkey shock titration, and Formalin test in rats.[27]

### 2.10. Effect of Tecoma Stans on damages done by electromagnetic radiation

Various studies have proved that the RF-EMR (Radio Frequency Electromagnetic Radiation) released by mobile phones may influence the brain in a variety of ways. The effects have been documented in a variety of in-vivo and in-vitro research. Effects on cerebral blood flow, blood-brain barrier permeability, oxidant and anti-oxidant balance, neurotransmitter balance, nerve cell injury, and genetic responses were among those studied. Wistar albino rats with a weight 200-300g of either sexed were utilised for the experiment. All animals were kept in well-ventilated polypropylene cages at 25 ± 2°C and 55-65 RH on a 12/12 h light/dark cycle, with free access to food (standard laboratory rodent's chow) and water.

The animals were classified into 3 groups each group has 6 animals. The first group was treated with vehicle orally every day. The second group was exposed to mobile phones radiations every day. The $3^{rd}$ group was exposed to radiations and treated with methanolic extract of

tecoma stans flower. For the experiment the electromagnetic radiations were produced by keeping a GSM phone in silent mode in the cage. For two months, animals were subjected to RF-EMR by giving them 5 minute calling intervals at 5 minute intervals for 1 hour every day. Each phone call lasted 5 minutes. The animals in the cage were free to move about. The wire mesh on top of the wood bottom cage kept the animals away from the phone. After every $15^{th}$ consecutive days of exposure, three rats from each group were assessed using a behavioural screening model of the central nervous system.

The tail suspension, forced swimming test, and actophotometer were used to study the impact of EMR on rats. When exposed to electromagnetic radiation, rats exhibit increased immobility and reduced locomotor activity.[10] It was observed that the Tecoma stans extract did not help in diminishing the effect after 15 days,[28] but it was discovered to reduce immobility and enhance locomotor activity after 45-60 days.[29]

### 2.11. Tecoma Stans' CNS depressant activity

Tecoma stans extracts have CNS depressive action.[30] Extraction solvents include chloroform, petroleum ether, methanol, and others. Diazepam, Morphine, Pentazocine, Chlorpromazine, and other medications were employed in these investigations. Albino mice of either sexes are often utilised to assess the impact of various Tecoma stans extracts on the CNS. The actophotometer-measured locomotor activity and Phenobarbitone-induced sleeping duration are employed to assess CNS depressant action. Similarly, the tail immersion and tail flick tests are used to measure analgesic activity.[20] The extracts listed above are also used to test the different Reflexes. Methods are used to analyse the pain response, the righting reflex, grip strength, the pinna reflex, the touch reaction, and so on.

### 2.12. Actophotometer locomotor activity

An actophotometer is a device that measures basal activity. The mice are divided into three groups and then put in the actophotometer chamber, where their baseline activity score is assessed. The three groups are then treated with a vehicle such as sodium CMC, a conventional medicine such as chlorpromazine, and the test drug, in that order. The baseline activity score is tested again after a given amount of time.[18] The use of medicines reduces the activity of the mice. The following formula may be used to calculate the percentage of activity reduction:

(Wa/Wb) x 100

Where Wa and Wb are the average scores after and before medication delivery.[1,20]

The administration of the vehicle has little effect on the baseline activity score. In contrast, as compared to the standard medicine, the test drug induces a considerable fall in the basal activity score.

### 2.13. Tecoma Stans analgesic activity

Pain is a broad phrase that refers to unpleasant feelings in the body. It starts in the nervous system. It is a painful sensation generated by powerful or harmful stimulation. Pain is induced by possible tissue injury. It is a significant symptom of various medical disorders. It is divided into two types: acute pain and chronic pain. Acute pain is an adaptive, protective reaction to tissue damage that is mediated by nociceptive pathways, while chronic pain is a maladaptive response that might be nociceptive or neuropathic in nature.[2]

Analgesics are a family of medications that are used to relieve pain. They are also called as pain relievers. They have a short-term impact. Analgesics work primarily by decreasing prostaglandin production by the enzyme cyclooxygenase[31] NSAIDs work by inhibiting inflammation. Two approaches are used to measure analgesic activity:

### 2.14. Test of tail immersion

The pain response to heat stimulation is measured using the tail immersion test. This test assesses the efficacy and tolerability of analgesics.[27]

The experiment is carried out on Swiss albino mice of both sexes. They are classified into five categories. As a vehicle, propylene glycol is utilised. The methanolic extract of Tecoma stans heartwood is utilised as the test drug, whereas morphine is employed as the reference drug since it is a powerful painkiller. Heartwood methanolic extract is given in increasing doses (50mg/kg, 100mg/kg, and 200mg/kg). The medicines are given intraperitoneally. After 30 minutes of medication delivery, the mice's tails are immersed in a pot of hot water kept at a temperature of 55 degrees. The time is recorded when the mouse removes its tail from the water. The time is shown in seconds.[20]

The mice given Propylene glycol had an extremely poor tolerance for hot water. While the groups given morphine and the test drug demonstrated equivalent tolerance to hot water. As the amount of the test medication grows, so does the tolerance to hot water. The test substance, a methanolic extract of Tecoma stans heartwood, has analgesic efficacy via improving pain tolerance.[20]

### 2.15. The tail flick test

It is comparable to the hot plate test. It is a pain response test in animals. It is a metric for acute nociception. In this test, a high-intensity laser beam is directed onto the animal's tail. Normally, the light induces a heat feeling in the animal, causing it to move its tail as a reflex movement. The amount of time it takes to move the tail is recorded. In this experiment, an analgesiometer is employed. The

heating element is made of nichrome wire.[31] In this experiment, both sexes of Wistar albino mice are employed. They've split it into five categories. The mice's tails are attached to the nichrome wire. As a control, propylene glycol is employed. Morphine and a methanolic extract of Tecoma stans heartwood are utilised as the standard and test drugs, respectively. The medicines are administered intraperitoneally. The time it takes the mouse to flick its tail is recorded. The time is taken 30 minutes after the medications are administered. The test medication is administered in escalating doses (50mg/kg, 100mg/kg, and 200mg/kg).

The injection of propylene glycol had no effect on the mice's pain tolerance. Morphine, a powerful painkiller, boosts the mice's pain tolerance. Meanwhile, it has been discovered that the test medication enhances pain tolerance. The pain tolerance is comparable to that induced by the conventional medication. As a result, the test chemical, a methanolic extract of Tecoma stans, has significant analgesic efficacy.[20,31]

## 3. Conclusion

According to early research, Tecoma stans has a variety of chemical compounds, each of which has distinct actions. Saponins, phenols, triterpenoids, alkaloids, flavonoids, volatile oils, and other chemical components are among them. Several investigations have shown that triterpenoids have CNS depressive action. As a result, the presence of triterpenoids may be ascribed to Tecoma stans' CNS depressive action. The extracts of Tecoma stans flowers have been proven in tests to exhibit CNS depressing effect via lowering locomotor activity. Locomotor activity was seen as an indicator of alertness, with a decrease indicating sedative activity. Furthermore, as compared to the control, various extracts of Tecoma stans flowers induced an earlier beginning of the impact of phenobarbitone[sleep latency] and considerably extended the period of action of pentobarbitone[sleeping time]. The test compound's sedative effect might be owing to interactions with benzodiapines and similar chemicals, which bind to receptors in the CNS. Tecoma stans has a similar pharmacological profile to benzodiazepine. As a result, the components may interact with the benzodiazepine receptor, which is located next to the GABA receptor.[18] GABA is involved in the effect of anti-anxiety, muscle relaxant, and sedative-hypnotic medications. The most vital neurotransmitters is gamma amino butyric acid (GABA). As a result, it is likely that Tecoma stans flower extracts work by beginning GABAergic inhibition in the CNS through membrane hyperpolarization, resulting in a decrease in the firing rate of key neurons in the brain, or by directly activating GABA receptors. Tecoma stans' CNS depressive action is assigned to the presence of numerous chemical ingredients found in different extracts. Tecoma stans neuropharmacology demonstrates analgesic action, which is also linked to the methanolic extract of Tecoma stans heartwood.

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## 5. Conflict of Interest

The author declares that there is no Conflict of interest

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