



Therapeutic Properties and Applications of *Tecoma stans* Linn.

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ABSTRACT

Tecoma stans Linn is a traditional plant in India. It is also known as yellow bells, yellow elder, trumpet flower, belonging to the family Bignoniaceae. It grows as a weed in India. Researchers on *T.stans* gives the evidence that it contains chemical constituents like alkaloids, amino acids, phytosterols, monoterpenes, triterpenes, glycosides, phenols, tannins, saponins and flavonoids. Pharmacologically *Tecoma stans* flower is traditionally used for many ailments including cancer, diabetes and arthritis. *Tecoma stans*, also shows antioxidant, wound healing, antispasmodic, antiproliferative, anti-inflammatory, antimicrobial, antifungal and cytotoxic properties. The gallic acid, a phenolic acid identified in this plant fraction may contribute to the anti-inflammatory activity. Ethyl acetate and alcoholic extract of this plant were also found to have significant inhibition to the carrageenan induced rat paw oedema. The present review comprises the pharmacological, phytochemical and therapeutic potential of *Tecoma stans*.

Keywords: Alkaloids, Monoterpenes, Flavonoids, Carotene, Antioxidant, Cytotoxic.

INTRODUCTION

Plants have provided a source of inspiration for novel drug compounds, as plant derived medicines have made large contributions of human health and well-being. Traditional medicine using plant extracts continues to provide health coverage for over 80% of the world's population, especially in the developing world.¹ Plants are used medicinally in different countries and are a source of many potent and powerful drugs.²

Medicinal plants provide good remedies for human diseases and play a vital role in our day to day life. Indian systems of medicines are all based on the knowledge of drugs from plants. Higher plants, as sources of medicinal compounds, have continued to play a dominant role in the maintenance of human health since ancient time. Over 50% of all modern clinical drugs are natural product origin and natural products play an important role in drug development programs in the pharmaceutical industry. In India people have been used plants and natural products for the treatment of various diseases from ancient time. In the last two decades of the century the scientists are sincerely trying to evaluate many plant drugs used in traditional system of medicine.

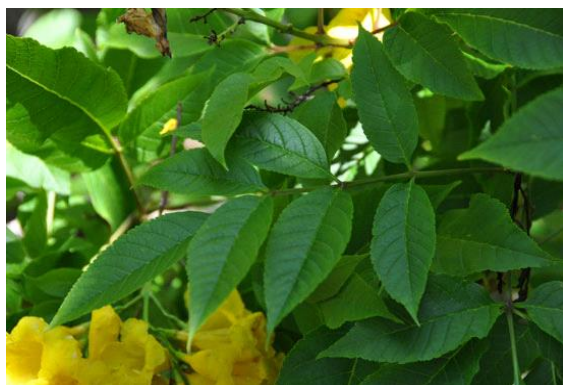
The pharmacognostical study is one of the major criteria for identification of plant drugs. Active compounds produced during secondary vegetal metabolism are usually responsible for the biological properties of some plant species used throughout the globe for various purposes, including treatment of infectious disease.³ Bignoniaceae family plants are also widely used in traditional medicinal systems of a number of countries, where folk and tribal medicinal practitioners use a number of species for treatment of diverse ailments. *Tecoma stans* is commonly

planted as an ornamental in warmer climates throughout the world because of its showy yellow flowers and pinnate foliage. *Tecoma stans* is an important medicinal plant. The major bioactive compounds like alkaloids, phenols, terpenoids, glycosides, flavonoids, saponins had been isolated from this plant. The leaves, bark and roots contains biologically active chemicals, and extracts from those tissues are in use as traditional folk medicines.⁴ The presence of phytoconstituents like phytosterol, triterpene, glycosides, phenols, flavonoids, saponins, and tannins either individually or combined together may exhibit the synergistic effect towards healing of wounds.⁵

Researchers revealed that it is having antidiabetic, anticancer, antioxidant, antispasmodic, antimicrobial, and antifungal properties and extensively used in the treatment of diabetes. This review aims at describing the traditional uses, phytochemical profiles and therapeutic potential of various parts of *Tecoma stans*.

Taxonomy

Kingdom	: Plantae
Division	: Tracheophyta
Subdivision	: Spermatophytina
Class	: Magnoliopsida
Order	: Lamiales
Family	: Bignoniaceae
Genus	: <i>Tecoma</i>
Species	: <i>stans</i>

*Tecoma stans* leaves*Tecoma stans* bark

Description

Tecoma stans is a promising species in the trumpet vine family, Bignoniaceae. The common names are yellow trumpet bush, yellow bells, yellow elder and esperanza. It is a flowering perennial shrub or small tree, 5-7.6 m in height. Bark is pale brown to grey and roughens with age. Leaves are opposite, compound and imparipinnate with 2 to 5 pairs of leaflets and a larger single terminal leaflet. Flowers occur in clusters at the ends of the branches and are trumpet shaped with 5 rounded lobes, 6 cm long, pale to bright yellow, with faint orange stripes at the throat. Stamens 4, attached at summit of tube in 2 unequal pairs, filaments pilose at base, curved above, anthers versatile, linear, yellow, pilose and 6 mm long; Fruits are narrow, slightly flattened to pointed capsules, up to 20 cm long, containing many winged seeds; green when young, pale brown on ripening and remain on the tree in untidy clusters for many months.⁶

Phytochemical Properties

Tecoma stans leaves bark, and roots contain many biologically active chemicals, and extracts from those tissues have been used in traditional folk medicine to treat many diseases and conditions. The major bio active compounds like alkaloids, phenols, terpenoids, glycosides, flavonoids, saponins has been isolated. These bioactive compounds contain various phytoconstituents. The phytochemical screening of the *Tecoma stans* plants varied according to the solvents used for the extraction of the leaves. Therapeutically important active principle of *Tecoma stan* is Tecomine (the alkaloids isolated from the

plant harvested in Egypt) was shown to be one of the compounds responsible for the hypoglycemic action given the interest in substances able to treat type II diabetes. The *Tecoma stans* leaves and barks both shows the anti-inflammatory activity. The biosynthesis of monoterpene alkaloids in callus tissues of *Tecoma stans* has been studied, together with the identification of the presence of lapachol and other primary and secondary plant metabolites such as: sugars (glucose, fructose, sucrose and xylose), triterpenoids (ursolic and oleanolic acids and α -amyryne), p-sitosterol and phenolics (chlorogenic, caffeic, vanillic, o-ceramics and sinapicn acids). Alkaloids namely 5 β Hydroxyskitanthine, early called Base C, and boschniakine were inactive both in vivo and in vitro assays. Other chemical constitutes are phytosterols, alkaloids, quinones, amino acids, monoterpenes, triterpene, glycosides, phenols, flavonoids, saponins, and tannins. Recently the presence of iridoid glycosides, indolic compounds in the leaves have been identified from this plant.⁷⁻¹¹

Pharmacological Activities

Tecoma stans have various pharmacological activities like antidiabetic, anti-inflammatory, wound healing, antimicrobial, antioxidant, cytotoxic, antifungal and anti-proliferative activity.

Anti-Diabetic activity

Aantidiabetic effect of *Tecoma stans* was attributed to alkaloids denominated tecomine and tecostanine.¹² It has been reported that sub chronic and acute administration of the alkaloid tecomine diminished plasmatic cholesterol and triglycerides levels without modifying fasting glucose.¹³ *Tecoma stans* aqueous extract of leaves exert its antidiabetic effects by stimulating glucose uptake in both insulin-sensitive and insulin-resistant murine and human adipocytes without significant proadipogenic or antiadipogenic side effects.¹⁴ In another study it has been reported that the ethanolic extract of *Tecoma stans* stem (200 mg/kg) showed statistically more significant in decrease blood glucose level. The ethanolic extract shows (147.5 \pm 4.4) more significant value, when compared to positive control group and near to standard group (124.6 \pm 3.9). The antidiabetic activity of ethanolic extract of *Tecoma stans* stem may be due to potentiation of insulin secretion from β -cells of pancreas. The potential antidiabetic activity may be due to the actions of phytochemicals such as flavonoids, saponins and alkaloids present in ethanolic extract of *Tecoma stans* stem.¹⁵

Anti-Inflammatory activity

The methanol, ethanol and water extracts of *T. stans* showed anti-inflammatory activity by inhibiting the heat induced albumin denaturation and red blood cells membrane stabilization.¹⁶ In another studies administration of alcohol extract at 250 and 500 mg/kg inhibited the edema from the 3h after carrageenan challenge, and aqueous extract at dose of 250 and 500 mg/kg inhibited the edema from 4h after carrageenan

challenge, which probably inhibits the different aspects and chemical mediators of inflammation.¹⁷

Wound healing activity

Wound healing process is a complex series of events that begins at the moment of injury and can continue for months to years. The stages of wound healing are inflammatory phase, proliferation phase, fibroblastic phase and maturation phase. Different extracts of the bark of *Tecoma stans* was evaluated for its wound healing potential in two different types of wound models in albino rats. The methanolic extract of *Tecoma Stans* (METS) leaf shows marked reduction in the wound area, significant increase in wound contraction and formation of scar in excision wound model when compared to controls. This activity is attributed to the presence of phytoconstituents like phytosterols, triterpenes, glycosides, phenols, flavonoids, saponins, and tannins either individually or combined together may exhibit the synergistic effect towards healing of wounds.¹⁸⁻²⁰

Antimicrobial Activity

The alcoholic and aqueous extract of *T. stans* exhibited the antibacterial activity and the growth of *E. coli* and *B. subtilis* was inhibited at different concentrations.²¹ The methanol extracts of leaves and stem bark of *Tecoma stans* was studied for their antimicrobial activity using a wide range of Gram-positive and Gram-negative bacteria and fungi. It was observed that the extracts of stem bark generally showed better antimicrobial activity than those of the leaves.²² In another study, the ethanol, methanol and water leaf extracts of *Tecoma stans* was tested on various bacteria (*Pseudomonas fluorescens*, *Clavibacter michiganensis*, *Staphylococcus aureus*, *E. coli*, *Pseudomonas aeruginosa* and *Klebsiella pneumonia*) and was found to be effective.²³ Phytochemical analysis revealed the presence of alkaloids, flavonoids, saponins, phenols, steroids, anthraquinones and tannins. The three extract fractions have showed highest total phenolic content (177-216mg gallic acid equivalent/g) which may be attributed to its antimicrobial activity.²⁴⁻²⁵ Flavonoids also have been proven to display a wide range of pharmacological and biochemical actions, like antimicrobial activities.²⁶

Antioxidant Activity

Plants are primary resources for antioxidants like carotenes, phenolic acids, etc., the phytochemical analysis Of *Tecoma stans* revealed that the plant has alkaloids, steroids, glycosides and carbohydrates.²⁷ Flavonoids can act as free radical scavengers and terminate the radical chain reactions that occur during the oxidation of triglycerides in the food systems.²⁸

The presence of tannins in the extracts may explain its potent bioactivities known to possess potent antioxidants.²⁹ The antioxidant activity of methanolic and ethanolic extract of *Tecoma stans* plants parts was

measured by the capability of DPPH free radicles scavenging in comparison to the standards, ascorbic acid and butylated hydroxytoulene. DPPH assay results show that methanolic extract of *T. stans* in higher concentration show better antioxidant potential than the standard L-ascorbic acid. They exhibited strong antioxidant potential at 20 µg/mL concentration.³⁰

Cytotoxic Activity

Cytotoxic effects of *Tecoma stans* were found to be concentration and time-dependent in the presence and absence of fetal bovine serum (FBS). Cytotoxicity was determined spectrophotometrically by MTT and reported in terms of % cell viability.³¹ In another study the cytotoxicity effects of different concentrations of alcoholic and aqueous extracts 100000(A), 50000(B), 25000(C), 12500(D), 6250(E), 3125(F), 1562.5(G), 781.2(H) µg mL⁻¹ were tested on normal mouse embryo fibroblast cell line (MEF) and treated cell line. The higher concentrations of the plant extracts had a significant cytotoxic effect than lower concentrations on the MEF cell line. Morphological assessment using inverted microscopy of the cultured cells indicated that cell death occurred in the treated cell lines. The active constitutes in the plant extract causes morphological changes and cell death.³²

Antifungal activity

Antifungal activities were tested by the drop diffusion method. *Tecoma stans* differ significantly in their activities against the microorganisms tested and most of the extracts showed antifungal activity against *Candida albicans*, *Cryptococcus neoformans* and *Microsporum gypseum*. *Tecoma stans* found to give the best zone of inhibition against the fungal activity. In another study *Tecoma stans* was tested against two species of subcutaneous fungi: *Sporothrix schenckii* and *Fonsecaea pedrosoi* by the agar dilution method at a concentration of 100 µ/mL. *Tecoma stans*, showed effective activity against *F. pedrosoi* at MIC 12.5 µg/mL.³³⁻³⁴

Anticancer activity

Natural products derived from medicinal plants have gained significance in the treatment of cancer.³⁵ Compounds which are derived from plants one or another way constitutes more than 50% of antiproliferative agents.³⁶⁻³⁷ Traditionally flowers and bark of *Tecoma stans* are used for treatment of various cancers. *Tecoma stans* leaves and bark shows anti proliferative activity. Report suggested that the hydroxyl groups of the aromatic rings (acteoside) appear to play an essential role in the antiproliferative effect.³⁸ A novel monoterpene alkaloid, 5-hydroxy-skytanthine hydrochloride isolated from *Tecoma stans* Juss. fruits and flowers are effective as an anti-proliferative against MCF-7 and as a NO inhibitor.³⁹ The invitro anti- proliferative activity of the various parts of the *Tecoma Stans* was studied in the Breast cancer. MCF-7 cell lines by MTT assay.⁴⁰ The stem, root, bark and flower extracts showed significant anti-proliferative action on the



cell line (MCF-7) but extreme action was found to be in extract stem bark of *Tecoma stans*.⁴¹ Another study shows a dramatic invitro anticancer activity of ethanolic leaf extract of *Tecoma stans* on human breast cancer cell line (MCF-7) at increasing concentrations with Inhibitory concentration 64.5µg/ml.⁴²

CONCLUSION

Tecoma stans is widely used by traditional medical practitioners for the treatment of various diseases. Literature survey shows wide spectrum of pharmacological activities in *Tecoma Stans*. This review has attempted to unite the relevant information regarding the unique therapeutic nature of this species, which clearly suggests future research priorities. Scientific investigations of this plant, *Tecoma stans*, showed that the crude extracts exhibited antidiabetic, antimicrobial, free radical scavenging, anti-inflammatory, wound healing, cytotoxic and anticancer properties. Phytosterols, alkaloids, quinones, amino acids, monoterpenes, triterpene, glycosides, phenols, flavonoids, saponins, and tannins are well known for their biological properties and although a suite of compounds belonging to this class of phytochemicals have been isolated, very few have been subjected to pharmacological assays. Researches on this plant are increasing day by day because of its potent pharmacological uses. However, further investigation employing isolation of constituents and screening models are needed for further confirmation of various potential of *Tecoma Stans*. This review was to collate the research work undertaken by various scientists at different places till date in order to provide a base line for future works.

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