Review Paper:

Mini Review: Therapeutic Potential of *Tecoma stans*

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Abstract

The plant Tecoma stans belongs to Bignoniaceae family. It is dicotyledonous in nature and shrub type plant with 2 to 4 meters height. This plant is generally grown along sides of streets and is also as an ornamental garden plant. Other names used for this plant are yellow bells, trumpet flower and yellow elder. All the parts of the plant including root, bark, leave, flower, fruit and seed are reported to have several medicinal and therapeutic properties. Chemical constituents of this plant includes alkaloids, anthraquinones, amino acids, flavonoids, glycosides, monoterpenes, phytosterols, phenols, quinones, saponins, tannins and triterpenes.

Presently, more focus is towards plant based herbal medicines for the remedial purposes of multiple diseases and medical conditions. Different parts of T. stans plant have been identified to possess anti-microbial, anti-oxidant, anti-diabetic, anti-proliferative, anti-inflammatory, anti-cancer, cytotoxic and wound healing properties. It is also used to treat digestive complications, diabetes, yeast infections, cancer and arthritis as well. This review article provides information and data on phytochemical, pharmacological and remedial potential of T. stans plant briefly.

Keywords: *Tecoma stans*, medicinal value, therapeutic properties.

Introduction

Globally, plants have acted as an affordable source of unique and novel compounds for different drugs. Plant based medicines have a great assistance to the wellbeing and health of humankind. Around 80% of the world's population has been covered by the traditional medicines derived from plant based extracts[24].

Several countries have been using different plants for the medicinal and clinical purposes since they are very powerful and effective sources of drugs[21]. Plants with medicinal properties have a vital and dynamic role in daily life of human since they are worthy source of multiple compounds to cure several diseases. Plant based medicine system is followed in India which is based on the knowledge of drugs derived from plants. Since ancient times, higher plants have played a leading role in the upkeep of human health because they are good source of medicinally active compounds.

Natural and plant derived products play a significant role in many pharmaceutical industries since more than 50% of all current medical drugs originate from natural compounds. Indian people have been using natural compounds derived from plants to treat several diseases from long back.

Scientists over the globe are genuinely trying to access and evaluate several plant-based drugs which have high therapeutic potential. One of the major criteria for the identification of plant based drugs is pharmacognostical study.

Biologically active compounds synthesized during secondary vegetal metabolic activities are generally accountable for the organic and natural properties of plants[11]. Specially, plants belonging to Bignoniaceae family are extensively used in several countries for traditional medicinal system. Ethnic and folk medical specialists use several plant species to treat various illnesses. *Tecoma stans* is one such plant with attractive yellow colored flowers and pinnate type foliage.

This plant generally grows in warmer climate conditions throughout the world. Extracts from plants' bark, leaves and roots possess several biological active constituents which are used in traditional medicines. This plant is a valuable source of biologically active constituents such as alkaloids, flavonoids, glycosides, phenols, saponins and terpenoids[13].

The existence of phyto-constituents such as flavonoids, glycosides, phytosterols, phenols, saponins, tannins and triterpene, independently or pooled together can demonstrate the wound healing effects[4]. P

ractically, all parts of this plant contain different therapeutic compounds. Plant leaves exhibit anti-bacterial activity, anti-cancer activity, anti-anthelmintic activity, wound healing property and anti-spasmodic effect[10]. Terrestrial parts of the plant possess anti-oxidant activity and wound healing activity.

Plant roots have shown anti-bacterial activity while flowers possess anti-cancer and anti-diabetic activities[22]. The objective of this review comprises of phyto-chemical depiction and remedial properties of *Tecoma stans*.

Figure 1: Plant picture of *Tecoma stans*. Flowers (1A), leaf (1B), fruit (1C)

Taxonomic classification

Domain	:	Eukayiota
Kingdom	:	Plantae
Subkingdom	:	Angiosperm
Phyllum	:	Tracheobionta
Subphylum	:	*Euphyllophytina*
Super division	:	Spermatophyta
Division	:	Magnoliophyta (Eudicots)
Class	:	Magnoliopsida - Dicotyledons
Subclass	:	Asteridae
Order	:	Scrophularials
Family	:	Bignoniaceae
Genus	:	*Tecoma*
Species	:	*Tecoma stans*

Plant description: *Tecoma stans* belongs to Bignoniaceae family and is a promising species from trumpet wine family. Other common names for this plant include esperanza, yellow bells, trumpet bush and yellow elder. It is a perennial shrub type of plant with capacity of flowering. It reaches up to 5 to 7 meter in height during its lifespan. It has pale brown to grey coloured bark which becomes soft with the age of plant. Leaves of plant are compound, imparipinnate with 2 to 5 leaflets pairs, larger solo terminal leaflet and opposite type. Plant fruits are up to 20 cm long, narrow, several winged seeds and somewhat packed down to pointed capsules. Fruit persists to stay on tree in messy bunches in green colour during young age and becomes brown coloured on ripening. Flowers are produced in bunches at the termination of branches, around 6 cm in length. It is light to bright yellow coloured with shadowy orange coloured stripes at the throat portion containing 5 circular lobes and trumpet type in shape. Total 4 stamens are attached at the top of tube in uneven pairs, yellow in colour, about 6 mm long, linear and versatile[17].

Phyto-chemical elements: Several types of biologically active phyto-constituents are possessed by bark, root and leaves of *Tecoma stans*. Traditional and folk medicines use different types of extracts from these parts of plant to cure several diseases and medical conditions. Significant amount of different bio-active compounds has been isolated including alkaloids, flavonoids, glycosides, phenols, saponins and terpenoids. Different types of phyto-chemicals can be isolated during screening of this plant with the use of diverse type of solvents for the extraction process. Plant bark and leaves possess anti-inflammatory activity. Tecomin is one of the important and key alkaloids isolated from this plant. It has significant importance in therapeutic purpose since it contains a crucial phyto-constituent which is accountable for hypo-glycmic property and act as a remedial agent for the treatment of type-II diabetes.

Studies have elucidated bio-synthesis of monoterpene alkaloids in the callus tissue together with existence of primary and secondary metabolites such as triterpenoids (α-amyrine, oleanolic acids and ursolic), phenolics (caffeic, chlorogenic, sinapicnacids, o-ceramics and vanillic), sugars (fructose, sucrose, glucose and xylose), lapachol and p-sitosterol. Alkaloids especially, boschniakine and 5β-hydroxyskitanthine (previously known as base C) were found to be inactive during *in vivo* and *in vitro* studies. In

recent times, the presence of indolic compounds and iridoid glycosides from the leaves of this plant has been discovered. Some other important phyto-constituents may also be present such as amino acids, flavonoids, glycosides, monoterpenes, phytosterols, quinones, saponins, tannins and triterpene which need to be confirmed[18].

Medicinal uses: *Tecoma stans* plant has been used since ancient times. Modern pharmacological studies also showed importance of this plant for remedial purposes. Due to its medicinal importance, different parts of the plant such as bark, root and leaves have been used as herbal medicine to cure several ailments. This plant is also used as a blood glucose level reducing agent in Latin and South America. Bark of the plant exhibits mild chloretic, cardio tonic and muscle relaxant activities. It is also used in treatment of digestive problems and controlling yeast infections. Roots of this plant act as powerful tonic, vermifuge and diuretic in nature. Grinded roots of the plant with lemon juice are reported to be used externally and also ingested in a small amount as a remedial purpose for the rat and snake bites[9].

Pharmacological activities: As per the pharmacology, an activity to describe the beneficial effects of a drug on living matter is known as biological activity/pharmacological activity. All drugs are a composition of a complex chemical mixture and plant substances also having active ingredient or pharmacophore which can be used directly or modified by the other constituents to check pharmacological activity. *Tecoma stans* has been screened for various pharmacological activities such as anti-microbial, anti-oxidant, anti-diabetic, anti-proliferative, anti-inflammatory, anti-cancer, cytotoxic and wound healing by multiple scientists.

1. Anti-microbial activity: Methanolic extract of bark and leaf of this plant has been studied for the anti-microbial activity against a broad range of fungi, gram positive and negative bacteria. As per the available results, it indicated that plant bark extract is more effective as compared to leaf extract for the anti-microbial activity[15]. Phyto-chemical evaluation also proved the existence of anthraquinones, alkaloids, flavonoids, phenols, saponins, steroids and tannins. Three extract fractions exhibited maximum content of total phenol (177-216 mg gallic acid equivalent/g) that can contribute to plant's anti-microbial activity[1].

Anti-microbial activity was also proven against the growth of *B. subtilis* and *E. coli* by aqueous and alcolholic extracts in different concentrations of this plant[2]. Another study showed that plant leaf extracts in water, ethanol and methanol were effective against different bacteria including *Clavibacter michiganensis, E. coli, Klebsiella pneumonia*, *Pseudomonas aeruginosa*, *Pseudomonas fluorescens* and *Staphylococcus aureus*[15].

2. Anti-oxidant activity: The occurrence of tannins possessing potent anti-oxidant activity has been reported in alcoholic extracts of this plant[25]. Termination of the radical chain reaction occurs during oxidation of the triglycerides. This can also happen by flavonoids present in the plant which acts as scavengers for free radicals[16]. 2,2-diphenyl-1-picryl-hydrazyl-hydrate (DPPH) assay was used to measure anti-oxidant activity of ethanolic and methanolic extracts of this plant parts against standards such as butylated hydroxytoulene and ascorbic acid. This assay proved that higher concentration of methanolic extract of plant has more anti-oxidant potential as compared to the standard ascorbic acid of 20 µg/ml concentration[19].

3. Anti-diabetic activity: Alkaloids such as tecostanine and tecomine are responsible for the anti-diabetic activity of *Tecoma stans*[7]. Studies have proven that the acute and sub-chronic administration of alkaloid such as tecomine reduced the levels of triglycerides and cholesterol[20]. Ethanolic extract of plant stem with concentration of 200 mg/kg showed statistically significant activity to decrease blood glucose levels. Ethanolic extract has shown more significant value to 147.5±4.4 mg/dl as compared to positive group control (standard value i.e. 124.6±3.9 mg/dl).

Potential anti-diabetic activity of stem's ethanolic extract of this plant is due to its ability to enhance insulin discharge from the pancreatic β-cells and phyto-chemicals such as alkaloids, flavonoids and saponins present in extract[5]. Aqueous extract of leaves also exhibits anti-diabetic activity by encouraging glucose intake in both, insulin sensitive and resistant human without any significant side effects[3].

4. Anti-inflammatory activity: Studies have proved that administration of aqueous and alcoholic extracts at concentration of 250 and 500 mg/kg has prevented edema in 4 h and 3 h time period respectively after carrageenan challenge that might prevent the altered aspect and inflammation due to chemical mediators. Anti-inflammatory action was also observed when inhibition of heat induced albumin denaturation and cell membrane stabilization of red blood cells were observed by ethanolic, methanolic and aqueous extracts of this plant[12].

5. Anti-cancer activity: Plant based natural products have achieved potential significance in the field of curing disease like cancer. Plant bark and leaves possess anti-proliferative activity. Flower and bark are also used traditionally to treat various types of cancers. Some of the studies have proved that the presence of hydroxyl groups of acteoside aromatic rings plays an important role in anti-proliferative effect[8]. This activity was also observed against MCF-7 cell line by 5- hydroxy-skytanthine hydrochloride, a monoterpene alkaloid in nature that was isolated from *Tecoma stans*.

One study showed that 64.5µg/ml concentration of ethanolic leaf extract of this plant possesses anti-cancer activity against breast cancer cell line MCF-7[23]. Plant bark, stem, flower and root extracts were also tested for their anti-proliferative activity against MCF-7 breast cancer cell lines.

Plant bark has shown highest anti-proliferative activity as compared to all other extracts of this plant[14].

6. Cytotoxic activity: In multiple studies, various concentrations of aqueous and alcoholic extracts of this plant were evaluated for their cytotoxic effect on mouse embryo fibroblast cell lines. Higher concentrations of these extracts were found potentially effective for their cytotoxic activity in this test. Death of treated cell line was confirmed by morphological examination using inverted microscopy. Some other studies also proved that, cytotoxic activity of this plant depends on time and concentration of the extract which also differ in the absence and presence of fetal bovine serum. Assessment of cytotoxicity was assessed by spectrophotometric analysis using MTT assay reported as % cell viability[6].

7. Wound healing activity: Wound healing activity was evaluated using methanolic extract of the plant bark in albino rats. The process of wound healing includes well defined cellular and biochemical events leading to progressive growth and rejuvenation of the wounded tissue area. Re-establishment of the wounded tissue portion occurs by activity of a complex network system including growth factors, blood cells and cytokines.

Wound healing effect of the plant was evaluated and research had proved that systematic administration and local application of methanolic extract of plant bark showed wound healing in both, incision and excision models. Wound healing activity might be result of either individual or combined effect of phyto-constituents such as flavonoids, glycosides, phenols, phytosterol, saponins, tannins or triterpene[4].

Conclusion

Tecoma stans has been extensively used to treat several diseased conditions by traditional medicine practitioners. Many modern research activities support the presence of wide spectrum of pharmacological ingredients in different parts of this plant. Several scientific studies with crude extracts of the plant have proved the presence of anti-microbial, anti-oxidant, anti-diabetic, anti-proliferative, anti-inflammatory, anti-cancer, cytotoxic and wound healing activities. The various phyto-constituents are present in the plant extracts such as alkaloids, amino acids, flavonoids, glycosides, phenols, phytosterols, saponins, tannins and terpenoids. These phyto-constituents are responsible for therapeutic properties either individually or in some combinations.

Investigations are in progress on this plant because of its vital and effective pharmacological applications. This review has made an effort to unite appropriate evidences undertaken by several scientists across the globe for the exclusive remedial and therapeutic properties of this plant to support human health and future research areas.

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(Received 07th February 2022, accepted 05th April 2022)