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Review Article

Tecoma stan: An Important Medicinal Plant

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The plant *Tecoma stans* (L.) Kunth, belongs to family Bignoniaceae and commonly known as "Piliya" in Rajasthan is a dicotyledonous herb popularly grown for its flowers as an ornamental /garden plant in normal gardens and temples. It is also known as *Bignonia stans* L. It has wide range of medicinal and pharmacological applications. Almost all parts (leaves, root, flower, seed, fruit, bark) of the plant is reported for its medicinal use. *Tecoma stans* is a herbal medicine used for treatment of diabetes, digestive problems, control of yeast infections, as powerful diuretic, vermifuge and tonic. Preliminary phytochemical screening of this plant revealed the presence of tannins, flavonoids, alkaloids, quinones and traces of saponins and amino acids. This review supports all updated information on its phytochemical and pharmacological activities and its traditional uses.

Keywords: *Tecoma stan*, Bignoniaceae, vermifuge, tonic, medicinal use, phytochemical screening.

INTRODUCTION

Tecoma stan is an ornamental plant is an erect, branched, sparingly hairy or nearly smooth shrub, about 2 to 4 meters in height. Its leaves are opposite, odd-pinnate, and up to 20 cm in length, with 4 to 5 leaflets. Leaflets are lanceolate to oblong-lanceolate, 6 to 13 cm long, pointed at both ends, and toothed at the margins. Flowers are yellow, faintly scented, borne in short, dense, terminal clusters. Calyx is green, 5 to 7 mm long and 5-toothed. The capsules are linear, compressed, 15 to 20 cm long, 6 to 8 mm wide, pointed and hanging from the branches. Seeds are numerous, less than 2 cm long, 7 mm wide and furnished with a transparent wing. It is widely distributed in cultivation[1]. Tecoma is a genus of 14 species of shrubs or small trees in the trumpet vine family, Bignoniaceae. Twelve species are from the Americas, while the other two species are African. The American species range from the extreme southern United States through Central America and the Antilles south through Andean South America to northern Argentina. The generic name is derived from the Nahuatl word tecomaxochitl, which was applied by the indigenous peoples of Mexico to plants with tubular flowers[2]. Its chemical constituents are phytosterols, alkaloids, quinines, amino acids, monoterpenes, triterpene, glycosides, phenols, flavonoids, saponins, and tannins[3]. Roots are reported to be diuretic, tonic, anti-syphilitic and vermifuge, decoction of flowers and bark are used for

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stomach pains, the whole plant is used in the treatment of diabetes. In Guadalajara, roots used for making beer[4].

Synonyms

Ginger-thomas, Yellow trumpet/ Yellow bells/ Yellow-elder.

Vernacular Name

Hindi – Piliya/ Pila kaner

English – Yellow bells

Kannada – Koranekelar

Tamil –sonnapatti

Telugu – Pachagotla

Bengali –chandaprabha

Marathi – Ghanti ful[5].

Distribution

Throughout India, South America, although, its native environment extends from southern Texas, New Mexico, and Arizona to Bolivia and northern Argentina and from Florida and the Bahamas to Trinidad in the Caribbean. This shrub has also become established in other tropical and subtropical areas such as in Africa, Asia, the Pacific Islands and Australia[6].

Culture

Yellow elder will grow on a wide variety of soils, including sand and limerock. The plants can be cut to the ground for rejuvenation in the early spring or carefully sheared during the growing season to control shape and size and promote new flushes of flowers.

Light: This species needs full sun.

Moisture: Yellow elder likes well drained soil. Potted plants should be given minimal water when not in active growth.

Fig.1 *Tecoma stan* with Leaflets

Fig.2 *Tecoma stan*

Hardiness: USDA Zones 7 - 11. Freeze tolerance varies dramatically, with some forms able to survive temperatures down to around 10ºF (-12.2º C) and others severely injured by only a few degrees of frost.

Propagation: Fresh seeds germinate readily in sandy soil in the spring. Cuttings root easily under mist in the summer.

(Choose vigorous young semi-woody branch tips - not old woody stems or fresh green shoots.) Bottom heat will encourage rooting in cooler weather[7].

Taxonomical Classification

Domain – Eukayiota

Kingdom - Plantae – Plant

Subkingdom –Angiosperm – Seeds are cover

Phyllum - Tracheobionta – Vascular plant

Subphylum - *Euphyllophytina*

Super division - Spermatophyta

Division – Magnoliophyta (Eudicots)

Class – Magnoliopsida - Dicotyledons

Subclass - Asteridae

Order – Scrophularials

Family – Bignoniaceae

Genus - Tecoma Juss

Species - Tecoma stans (L) Juss. Ex **Kunth**– yellow trumpetbush[8].

Other species of Tecoma -

- Tecoma arequipensis (Sprague) Sandwith
- Tecoma capensis (Thunb.) Lindl. – Cape Honeysuckle (Southern Africa)
- Tecoma castanifolia (D.Don) Melchior – Chestnutleaf Trumpetbush
- Tecoma cochabambensis (Herzog) Sandwith
- Tecoma fulva (Cavanilles) D.Don
- Tecoma garrocha Hieronymus
- Tecoma guarume DC.
- Tecoma nyassae Oliv.
- Tecoma rosifolia Humboldt, Bonpland & Kunth
- Tecoma sambucifolia Humboldt, Bonpland & Kunth
- Tecoma stans (L.) Juss. ex Humboldt, Bonpland & Kunth – Yellow Trumpetbush (Americas)
- Tecoma tanaeciiflora (Kränzlin) Sandwith
- Tecoma tenuiflora (DC.) Fabris
- Tecoma weberbaueriana (Kränzlin) Melchior[9].

Chemical constituents

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 two other alkaloids isolated, namely 5β-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[10].

Phytochemical Studies

Phytochemical investigation of Tecoma stans fruits and flowers resulted in the isolation of a new phenylethanoid,2-(3,4-

Table 1: Analysis of different extracts of *Tecoma stan* for different chemical constituents[11]

		Extracts		
Componentes	**Tests/Reagents**	**Aqueous**	**Ethanolic**	**n-Hexane**
Alkaloides	Wagner	+	+	+
Coumarines	NaOH	+	+	+
Flavonoides	Salkowski	+	+	+
Sesquiterpen lactons	Baljet	+	+	+
Esteroles and metilesteroles	Liebermann-Burchard	-	+	+
Carbohydrates	Molisch	+	-	-
Saponines	Liebermann-Burchard	-	+	+
Quinones	Borntrager	-	+	-
Insaturaciones	$KMnO_4$	+	+	-

- The constituent was not found
+ The constituent was present

dihydroxyphenyl)ethyl-2-O-[6-deoxy-alpha -L-mannopyranosyl -4-(3,4- dihydroxy phenyl)-2-propenoate]-beta-Dglucopyrano side[3], and a novel monoterpene alkaloid, 5-hydroxyskytanthine hydrochloride[8],4-O-Ecaffeoyl- alpha-L-rhamnopyranosyl-(1' -->3)-alpha/beta-D-glucopyranose (1),E/Z acetoside[2], isoacetoside[4], rutin[5] , luteolin 7-O-beta-D-neohespridoside[6], luteolin 7-O-beta-D-glucopyranoside[7] and sucrose[9] were isolated from the fruits, while luteolin 7-O-beta-Dglucuronopyranoside[10], diosmetin 7-O beta-D-glucuronopyranoside [11], diosmetin -7-O-beta-D-glucopyranoside[12], diosmetin7-O-beta-D-glucuronopyranoside methyl ester[13] and acetoside[2] were isolated from the flowers. The novel compound 8 is effective as anti-proliferative agent against MCF-7 cells and as NO inhibitor, whereas 2 exhibited multi-functional properties as antioxidant and anti-proliferative agent against both solid tumor cell lines Hep-G2 and MCF-7 cells[12]. Indole, tryptophan, tryptamine and skatole were isolated from the leaves of Tecoma stans. The presence of both indole and anthranilic acid in the leaves of Tecoma stans indicates that they are the true substrate and product of indole oxygenase from the leaves of Tecoma stans[13]. 2, 3-Dihydroxybenzoic acid has been shown to be oxidized via the 3-oxoadipate pathway in the leaves of Tecoma stans. The formation of 2-carboxy-cis, cismuconic acid, a may in the leaves of Tecoma muconolactone. 3-oxoadipic acid and carbondioxide during its metabolism has been demonstrated using an extract of Tecoma leaves[14].

Comparison of metabolite levels in callus of Tecoma stans (L.) Juss. ex kunth cultured antioxidant activity and both phenolic compound and flavonoid total content were determined for callus tissue of T. stans cultured in either a set photoperiod or in darkness. Callus lines from three explant types (hypocotyls, stem, and leaf) were established on B5 culture medium supplemented with 0.5µM 2,4-D and 5.0 µM kinetin. While leaf-derived callus grew slower under a 16-h photoperiod (specific growth rate, µ = 0.179 d−1, t D = 3.9 d) than in darkness (µ = 0.236 d−1, t D = 2.9 d), it accumulated the highest amount ($p < 0.05$) of both phenolics (86.6 } 0.01 mg gallic acid equivalents/g) and flavonoids (339.6 } 0.06 mg catechin equivalents/g). Similarly, antioxidant activity was significantly higher ($p < 0.05$) when callus was cultured in period light than when grown in extended darkness. Antioxidant activity measured with a 2,20-azinobis (3-ethylbenzothiazoline-6-sulphonic acid) diammonium salt (ABTS)-based assay was 350.5 } 15.8 mmol Trolox/g extract for callus cultured under a defined photoperiod compared to 129.1 } 7.5 mmol Trolox/g extract from callus cultured in darkness. Content of phenolic compounds and flavonoids was in agreement with a better antioxidant power (EC50 = 450 µg extract/mg 1, 1-diphenyl-2-picrylhydrazyl) and antiradical efficiency. Results of the present study show that calli of T. stans are a source of compounds with antioxidant activity that is favored by culture under a set Photoperiod[15].

Medicinal uses

Traditional Uses-Almost all the parts of *Tecoma stans* are of medicinal importance and used traditionally for the treatment of various ailments. South America and Latin America used traditionally for reducing blood glucose. The Tecoma stans leaves, barks and roots have been used for a variety of purposes in herbal medicine. Bark shows smooth muscle relaxant, mild cardiotonic and chloretic activity. Applications include the experimental treatment of diabetes, digestive problems, control of yeast infections and other medicinal applications. It contains several compounds that are known for their catnip-like effects on felines. The root of the plant is reported to be a powerful diuretic, vermifuge and tonic. A grinding of the root of tecoma stans and lemon juice is reportedly used as an external application and also taken internally in small quantities as a remedy for snake and rat bites[16-18].

Pharmacological Activities –

(1) *Antioxidant Activity*: K. Springob et al reported Antioxidant activity and both phenolic compound and flavonoid total content were determined for callus tissue of

T. stans cultured in either a set photoperiod or in darkness. Results of the present study show that calli of T. stans are a source of compounds with antioxidant activity that is favored by culture under a set photoperiod[19].

(2) *Anti-Inflammatory Activity*: Sawapna Chaudhary et al evaluated the anti-inflammatory activity of chloroform root extract of *Tecoma stans*. Chloroform extract was analyzed for antiinflammatory activity against carrageenan-induced paw edema method in Wistar albino rats. In control group simple distilled water, in standard group Aspirin (100 mg/kg) and in test groups chloroform extract (100mg/kg, 200mg/kg) were administered orally. After 30 minutes, 1% w/v carrageenan solution was injected intraperitoneally and the paw volume of control, standards and test groups were noted at 1hr, 2hr, 3hr and 4hr time interval. Anti-inflammatory effects of the extracts showed significant anti-inflammatory activity at 200mg/kg (% of inhibition of paw edema 50.93 at 4 hrs.) as compared to control[20].

(3) *Antidiabetic Activity*:- *Tecoma stans* aqueous extract (TAE) of leaves is widely used as a traditional antidiabetic remedy in Mexico. Tecomine was shown to be one of the compounds responsible for the hypoglycemic action. Aguilar-Santamaria et al evaluated *in vivo* and *in vitro* intestinal α-glycosidase inhibition as the possible mode of action of TAE on type 2 diabetes mellitus (DM2) animal models[21]. The intravenous administration of *Tecoma stans* infusion in normal dogs produces an early hyperglycemic response and arterial hypotension followed by a slow decrease of the glucose blood values with a concomitant hypertriglyceridemia; no important changes in immunoreactive insulin were detected. Heart frequency was gradually increased after the first 60 min of drug administration and persisted for several hours. The effects observed on blood parameters seem to be related to hepatic glycogen metabolism, involving an activation of glycogenolysis. The late hypoglycemic effect of *Tecoma stans* infusion could be considered secondary to the observed hepatic glucose output. The study represents an attempt to elucidate the popularly attributed antidiabetic properties of this Mexican medicinal plant[22].

(4) *Antimicrobial Activity*:- The methanol extracts of the leaves and stem bark of Bignoniaceae Linn *Tecoma stans* was studied for their antimicrobial activity using a wide range of Gram-positive and Gram-negative bacteria and fungi. Methanol extracts of *Tecoma stans* leaves was found to be effective against only Candida albicans. It was observed that the extracts of stem bark generally showed

better antimicrobial activity than those of the leaves and some organisms were selectively more sensitive to the extracts than others[23].

(5)*Antispasmodic Activity*:- M.K. garib naseri et al investigated the effect of leaves extract of *Tecoma stans* on rat ileum contractility and involved mechanism(s). *Tecoma stans* Juss hydroalcoholic leaf extract (TLE) was prepared by maceration method using 70% alcohol. Distal segment of ileum (2 cm) from male Wistar rat was mount in an organ bath Containing tyrode solution (10 ml, pH 7, 37 °C) and pre-contracted by carbachol (CCh, 10 µM) or by KCl (60 mm). The antispasmodic effects of TLE (0.125–2 mg/ml) were studied prior and after 20-30 min incubation of ileum with propranolol (1µM), naloxone (1µM), LNAME(100µM), or 5 min incubation with glibenclamide (10 µM) and tetraethyl ammonium (TEA, 1mm). The effect of TLE on $CaCl_2$-induced contraction in Ca^{2+}-free with high K^+ Tyrode solution was also studied.The CChand KCl-induced ileal contractions were reduced by TLE ($P<0.0001$). This effect was not attenuated by propranolol, naloxone, LNAME, glibenclamide and TEA. In Ca^{2+}- free tyrode solution with high K+, cumulative concentrations of $CaCl_2$ induced contractions which were inhibited by TLE dose dependently. Our results indicate that the *Tecoma stans* (L.) leaf extract induces its antispasmodic effects without involvement β-adrenoceptors, opioid receptors, potassium channels and NO production. It seems that, the calcium channels are involved in this spasmolytic effect[24].

(6) *Wound healing activity*: C. Das, S.Dash, D.C Sahoo, A. evaluated the methanolic bark extract of *Tecoma stan* linn for wound healing activity in albino rats. Wound healing processes are well organized biochemical and cellular events leading to the growth and regeneration of wound tissue in a special manner. Healing of wounds involves the activity of an intricate network of blood cells, cytokines, and growth factors which ultimately leads to the restoration to normal condition of the injured skin or tissue**.** The aim of wound care is to promote wound healing in the shortest time possible, with minimal pain, discomfort, and scarring to the patient and must occur in a physiologic environment conducive to repair and regeneration. Wound healing activity of *Tecoma stans* was studied and the results suggest that local application and systemic administration of methanol extract of the bark has shown more significant wound healing activity in excision and incision wound models and support the popular use of plant to open wound in folk medicine.

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[25].

CONCLUSION

Tecoma stans is widely used as a traditional antidiabetic remedy in Maxico. Literature survey shows wide spectrum of pharmacological activities of *Tecoma stan*. *Tecoma stans* is used for treatment of diabetes, digestive problems, control of yeast infections, as powerful diuretic, vermifuge and tonic. However, further investigation employing isolation of constituents and screening models are needed for further confirmation of wound healing potential of *Tecoma stans.*

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