Journal of Advances and Scholarly Researches in Allied Education
Vol. 17, Issue No. 1, April-2020, ISSN 2230-7540

Tecoma Stans Linn Juss. Ex kunth (Herbal Medicine): A Review of its Therapeutical Properties and Performance

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Abstract - The Tecoma stans Linn has been used for centuries in Indian medicine. It is a member of the Bignoniaceae family and has several common names, including "yellow bells," "yellow elder," and "trumpet flower." There, it is considered a weed. T. stans has been shown to have chemical components such as alkaloids, amino acids, phytosterols, monoterpenes, triterpenes, glycosides, phenols, tannins, saponins, and flavonoids, according to the research conducted on the plant. Leaves, roots, flowers, seeds, fruits, and bark, among other plant parts, have all been claimed to have therapeutic effects. Tecoma stans is a potent diuretic, vermifuge, antisyphilitic, stomach pain reliever, and tonic used for treating diabetes, gastrointestinal issues, and the prevention of yeast infections. It was found during preliminary phytochemical screening and isolation that this plant included tannins, flavonoids, phenols, anthraquinones, glycosides, alkaloids, quinones, and trace amounts of saponins and amino acids. A number of diseases, including cancer, diabetes, and arthritis, have long been treated with the Tecoma stans flower's pharmacological benefits. Tecoma stans has been found to have a wide variety of antibacterial, antifungal, cytotoxic, antimicrobial, antispasmodic, anti-inflammatory, and antiinflammatory activities. This plant extract has been found to contain gallic acid, a phenolic compound that has anti-inflammatory properties. Similar results were observed with ethyl acetate and alcoholic extract of this plant on carrageenan-induced rat paw oedema. Pharmacological, phytochemical, and medicinal applications of Tecoma stans are discussed in this article.

Keywords - Tecoma stan Lan, tannins, flavonoids, phenols, anthraquinones, glycosides, alkaloids, quinones, saponins, antibacterial, antifungal, cytotoxic, antimicrobial.

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INTRODUCTION

Tecoma stans Linn. is known to have various medicinal and therapeutic properties. A native of Central America, this shrub or tree can grow up to 5 metres in height. Its vivid yellow bell-shaped blossoms grow up to 5 cm in length, making it a popular decorative plant in many warm areas. The flowering plant is beautiful and should be cultivated for its aesthetic value. It can be kept in bloom for an extended period of time by removing spent flower heads in climates with consistent humidity. Straggly growth is a common problem with this plant. If you trim it back severely, don't worry, it will bounce back shortly. It can be used as a pretty hedge plant with flowers. Usually only tiny pieces of the larger timber—which is light brown, close-grained, takes an excellent polish, and is durable—are available. The plant has historically been utilised by Native Americans to create bows, but in its native Mexico, it is now considered to be of little value. The plant is thought to have diuretic, tonic, antisyphilitic, and vermifugal qualities; specifically, the roots. Some people in Mexico claim that drinking a decoction made from the flowers and bark of this plant can cure diabetes. A type of beer brewed from the root was reportedly produced in Guadalajara, Mexico (2). Some say the mildly fragrant blossoms produce a wealth of honey (2). Six different

alkaloids have been identified by phytochemical analysis; two of these, tecomine (tecomanine) and tecostanine, may have hypoglycemic effects (1; 3). The fatty oil content of the seeds is 23%, and it is made up of the following: octadecatrionoic acid (41%), octadecadienoic acid (24%), octadecatetraenoic acid (19%), octadeconic acid (7%), palmitic acid (6%), and stearic acid (3%). The plant is said to contain a volatile oil, as well as unidentified triterpenes, hydrocarbons, resins, and a volatile liquid (1).

A pharmacognostical analysis is a crucial step in the process of determining the medicinal value of a plant. Some plant species are employed around the world for a variety of purposes, including the treatment of infectious disease, and their active chemicals created during secondary vegetal metabolism are typically responsible for their biological qualities. 3 Some members of the Bignoniaceae family are utilised by traditional medicine practitioners to treat a wide range of illnesses. Tecoma stans, with its bright yellow flowers and pinnate leaves, is a popular ornamental in regions with year-round mild weather. The tecoma stans plant is used for its therapeutic properties. Alkaloids, phenols, terpenoids, glycosides, flavonoids, and saponins are just some of the key bioactive chemicals extracted from this plant. Traditional herbal medicine relies on extracts made from the leaves, bark, and roots because they contain biologically active compounds.(4) The presence of many phytoconstituents, such as phytosterol, triterpene, glycosides, phenols, flavonoids, saponins, and tannins, may have a synergistic effect on wound healing. (5)It has been widely used to treat diabetes, and research has shown that it has antidiabetic, anticancer, antioxidant, antispasmodic, antibacterial, and antifungal qualities. Traditional use, phytochemical profiles, and therapeutic potential of Tecoma stans sections are the focus of this paper.

Figure 1: Tecoma stan with Leaflets

Figure 2: Tecoma stans bark

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.

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].

DESCRIPTION

A semi-evergreen shrub that can grow to a small tree, it boasts highly serrated, opposite green leaves that are pinnate unpaired, with 3 to 13 serrate, 8 to 10 cm long leaflets. The blades of the glabrous, bipinnate leaves are elliptical and range in size from 2 centimetres to 10 centimetres in length. They are only 1 centimetre to 4 centimetres wide. There are tiny teeth along the edge. It can grow as tall as 9 metres.

Flowers are clustered at the tips of the branches and range in size from 3.5 to 8.5 cm in length. They are golden yellow in colour and have five lobes (with weakly two lips) and are often reddish-veined in the throat. Flowering goes place all year long. The resulting capsule-like fruits, which develop from two separate carpels, can be up to 25 centimetres in length. Pollinators including bees, butterflies, and hummingbirds flock to the blossoms. [4] The plant's pods yield papery-winged yellow seeds. Once they open, they release a swarm of seeds that have membranes for wings. The tecoma stans can reproduce either sexually (through anemochory) or asexually.

SPECIES DISTRIBUTION

Native: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, French Guiana, Guatemala, Guyana, Haiti, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Puerto Rico, Surinam, Uruguay, Venezuela.

Exotic: Benin, Burkina Faso, Cameroon, Chad, Cote d'Ivoire, Gambia, Ghana, India, Kenya, Liberia, Mali, Mauritania, Niger, Nigeria, Pakistan, Rwanda, Senegal, Sierra Leone, Sudan, Tanzania, Togo, Uganda, United States of America.

Figure 3: Distribution of Tecoma stans both in native and exotic range around the world

Countries where the Tecoma stans species has been introduced are highlighted in the map above. It does neither mean that the species can be planted in every biological area within that country, nor that the species cannot be planted in other countries than those depicted. Since some tree species are invasive, you need to adopt proper biosafety tools and practises that pertain to your planting site.

PHYTOCHEMICAL STUDIES

Table 1: shows the biological activities which are based on Dr. Duke's phytochemical and ethnobotanical databases created by Dr. Jim Duke of the agricultural research service/USDA 2013.

S. No	Name of the compound	Biological activity
1	Tetradecanoic acid	Antioxidant, Lubricant, Hypercholesterolemic, Cancer-preventive, Cosmetic
2	Hexadecanoic Acid, Ethyl Ester	Antioxidant, hypocholesterolemic, Anti androgenic, hemolytic, Alpha reductase inhibitor.
3	l-(+)-Ascorbicacid	Vitamin C, Antioxidant, Immunomodulator
4	N-Nonadecanol-1	Antiinflammatory, Hypocholesterolemic, Cancer preventive, Hepatoprotective, Nematicide, Insectifuge Antihistaminic, Antiarthritic, Anticoronary, Antieczemic Antiacne, 5-Alpha reductase inhibitor Antiandrogenic,
5	9,12-Octadecadienoic Acid (Z,Z)-	Hypocholesterolemic, 5-Alpha reductase inhibitor, Antihistaminic, Insectifuge, Antieczemic, Antiacne

Table 2: Detection of chemical constituents of Tecoma stan analyzed using different extracts

		Extracts		
Componentes	Tests/Reagents	Aqueous	Ethanolic	n-Hexane
Alkaloides	Wagner	+	+	+
Coumarines	NaOH	+	+	+
Flavonoides	Salkowski	+	+	+
Sesquiterpenlactons	Baljet	+	+	+
Esteroles andmetilesteroles	Liebermann-Burchard	_	+	+
Carbohydrates	Molisch	+	_	_
Saponines	Liebermann-Burchard	_	+	+
Quinones	Borntrager	_	+	_
Insaturaciones	KMnO4	+	+	_

- The constituent was not found

+ The constituent was present

THERAPEUTIC APPLICATIONS (REMEDIAL USE)

In traditional medicine, nearly every component of the plant is considered useful for treating illness. Use for lowering blood sugar dates back centuries in South and Latin America. Various parts of the Tecoma stans plant, including the leaves, bark, and roots, have found uses in herbal medicine. Chlorotic activity, modest cardiac tonic effects, and the ability to relax smooth muscles have all been observed in bark. Diabetic therapy, digestive issues, yeast infection prevention, and other medical uses are all possible outcomes of this line of research. A number of the compounds in it have been shown to have the same stimulating effects on felines as catnip.

The plant's root is said to have strong diuretic, vermifuge, and tonic properties. According to folklore, snake and rat bites can be treated by applying a paste made from ground Tecoma stans root and lemon juice topically, or by ingesting a tiny amount of the mixture.

PHARMACOLOGICAL ACTIONS

A. Antioxidant Activity

Antioxidant activity, phenolic compound concentration, and flavonoid content were all measured in callus tissue of Tecoma stanscultured under a controlled photoperiod or in total darkness by Alma R et.al. in 2009.

Results of the present study demonstrate that calli of Tecoma stansare a source of chemicals with antioxidant activity that is favoured by culture under a set photoperiod.

B. Anti-Inflammatory Activity

The anti-inflammatory effects of Tecoma stans chloroform root extract were studied in 2009 by Sawapna Chaudhary. Extracts of chloroform were tested for their anti-inflammatory effects using the carrageenan-induced paw edoema method in Wistar albino rats. A placebo (distilled water), a standard dose (Aspirin, 100 mg/kg), and two experimental doses (chloroform extract, 100 mg/kg, 200 mg/kg) were all orally administered to the control group. After 30 minutes, an intraperitoneal injection of 1% w/v carrageenan solution was given, and the paw volume of the control, standard, and test groups was measured at 1, 2, 3, and 4 hours. At 200mg/kg, the extracts showed significant anti-inflammatory activity (% inhibition of paw edoema 50.93 at 4 hrs. vs. control).

C. Cardio-protective effect

Devastating cardiovascular illnesses are a leading cause of death worldwide. Myocardial necrosis, caused by an inadequate supply of oxygen to the heart muscle, is the hallmark of a myocardial infarction. Ischemic heart disease, atherosclerosis, and congestive heart failure are all cardiovascular diseases (CVDs) that can result from an increase in the toxic reactive oxygen species O2-, H2O2-, OH-, etc. Exerting a simple oxidative pressure on myocardium, these conditions can be the result of a lifetime of smoking. Animal testing provides an estimate of the myocardium's antioxidant activities, demonstrating that Tecoma stans has a cardio protective effect.

D. Cytotoxicity study

Cell death is the result of cytotoxicity. For this study, human hepatoblastoma cells were incubated with varying concentrations of Tecomastans for up to 72 hours to ascertain the extract's cytotoxicity. Tecomastans' toxic effects in the presence and absence of foetal bovine serum were initially hypothesised to be time- and focus-dependent.

E. Antidiabetic Activity

Tecoma stans leaf extracts are widely used in Mexico as an alternative treatment for diabetes. Hypoglycemic activity has been linked to a compound called tecomine. Animal models of type 2 diabetes mellitus (DM2) were evaluated in vivo and in vitro by Aguilar-Santamaria et al., who looked at the effect of tecoma aqueous leaf extract on the enzyme intestinal -glycosidase. The intravenous administration of Tecoma stans infusion in normal dogs produces an yearly hyperglycemic response and arterial hypotension sfollowed by a slow decline of the glucose blood values with a concomitant hypertriglyceridemia, but no important changes in immuno reactivity insulin were detected.

F. Antimicrobial Activity

The antibacterial activity of Tecoma stans methanol extracts against a wide variety of gram-positive and gram-negative bacteria and fungi was investigated.

Only Candida albicans was found to be inhibited by Tecoma stans leaf methanol extracts. Some species were found to be selectively more susceptible to the extracts than others, and it was found that stem bark extracts generally demonstrated better antibacterial activity than those of the leaves.

G. Antispasmodic Activity

The effect of Tecoma stans leaf extracts on rat ileum contractility and the underlying mechanism was studied by M.K. garibnaseri et al. in 2007. In order to create Tecoma stanshydro alcoholic leaf extract (TLE), 70% alcohol was macerated with the leaves. The distal 2 cm of ileum from male Wistar rats was mounted in an organ bath containing Tyrode solution (10 ml, pH 7, 37 °C) and pre-contracted with either carbachol (CCh, 10 M) or KCl (60 mm). TLE (0.125-2 mg/ml) was tested for its antispasmodic effects before and after a 1-mM concentration of propranolol, 1-mM concentration of naloxone, 100-mM concentration of L-NAME, or 5-minute concentration of glibenclamide and tetraethyl ammonium hydroxide were added to the ileum for 20-30 minutes (TEA, 1mm). Ca^{2+}-free, high K^{+} Tyrode solution was used to examine TLE's impact on CaCl2-induced contraction. When compared to the control group, TLE significantly attenuated the CChand KCl-induced ileal contractions (P0.0001). Propranolol, naloxone, LNAME, glibenclamide, and tert-butyl acetate (TEA) did not reduce this impact.

H. Wound healing activity

The wound healing activity of a methanolic bark extract of Tecoma stan linn was estimated by C. Das, S.Dash, and D.C. Sahoo in 2010A. Biochemical and cellular activities leading to wound tissue growth and regeneration are carefully managed in wound healing methods. Restoring damaged skin or tissue to its natural state after an injury requires the coordinated efforts of numerous cell types, cytokines, and growth factors. Healing of wounds should be accelerated as much as feasible within a physiological setting that allows for tissue repair and regeneration with as little discomfort, pain, and scarring to the patient as possible. Results from a study on the wound-healing properties of Tecoma stans indicate that a methanol extract of the bark has exhibited more significant wound-healing activity in excision and incision wound models, lending credence to the plant's traditional use in the treatment of surgical incisions. Wound healing may be aided by a synergistic effect caused by the presence of phytoconstituents like phyto sterol, triterpene, glycosides, phenols, flavonoids, saponins, and tannins.

RISK AND IMPACT FACTORS OF TECOMA STANS

Invasiveness:

It has proven to be invasive outside of its natural region, is very adaptable to a variety of settings, and is invasive wherever it is found. great local mobility, high reproductive potential, propagules that can remain alive for more than a year, resistance to cultivation, browsing pressure, mutilation, fire, etc. Damaged ecosystem services, ecosystem change/habitat alteration, adverse effects on agriculture, tourism, amenity values, and native biodiversity are all results of impacts.

Mechanics of Effect: Resource monopolisation due to competition, Suffocation due to competition, Pest and disease spread.

Potential for introduction/control: Very likely to be smuggled across international borders on purpose; Hard to regulate and very expensive.

CONTROL AND PREVENTION

The most effective strategy involves combining different types of management, such as limiting mechanical and chemical spread and sales by the nursery trade.

Manipulated Mechanically: One of the greatest ways to stop the spread of Tecoma stans is to keep

the ground covered vigorously, avoid overgrazing, and restore disturbed areas.

If you want to find seedlings that can be hand-pulled, you'll need to do frequent inspections of pastures and forest edges.

You can use a tractor to pull out bigger plants, but unless you burn the roots when they're dry, they'll just regrow and generate another infestation quickly.

It's crucial to restore these places following destructive practises like clearing and burning. At least one more round of control to get rid of the regrowth will be required following the first round (Kranz and Passini 1996, 1997).

Biological control: In South Africa, researchers are evaluating the host specificity of two rust fungus species, the microcyclic Prospodium transformans and the macrocyclic P. appendiculatum from Mexico. Although P. appendiculatum is already established in Brazil and Argentina, it is not significantly contributing to population suppression there. There will be more searches for natural adversaries of the host species. In South Africa, potential biological control measures include the introduction of a raceme-feeding membracid and the pyralid pod-feeding moth, Clydenopteron sp., into quarantine.

CONCLUSION

Tecoma stans has a long history of usage in alternative medicine for the treatment of a wide range of conditions.

The pharmacological effects of Tecoma Stans are quite varied, as evidenced by the research literature. This article has made an effort to consolidate data on the special medicinal value of this species, which should help direct research efforts in the future. Anti-diabetic, anti-microbial, free radical scavenging, anti-inflammatory, wound healing, cytotoxic, and anticancer effects were discovered in the crude extracts of the Tecoma stans plant, according to scientific studies. Although many phytochemicals have been isolated, including those with well-known biological properties like phytosterols, alkaloids, quinones, amino acids, monoterpenes, triterpene, glycosides, phenols, flavonoids, saponins, and tannins, only a small fraction of these compounds have been put through pharmacological testing. Since this plant has such promising pharmaceutical applications, research into it is expanding at a rapid rate. If we're going to confirm the many possibilities inherent in Tecoma Stans, more research is needed that involves isolating ingredients and screening models. The purpose of this review was to compile the research done by different scientists in different regions up to this point to serve as a benchmark for future studies.

Despite its high allelochemical content, the Maxican people frequently turn to Tecoma stans as an alternative treatment for diabetes. A review of the relevant literature reveals that Tecoma stan has both pharmacological and allelopathic properties. The high therapeutic potential of Tecoma stans is due to the abundance of its active phycoconstituents. This review found that different plant parts have different pharmacological effects, such as anti-inflammatory, analgesic, anticancer, cardio-protective effect, genotoxic, cytotoxic, wound healing, anti hyperglycemic, protect CNS, gastric ulcer healing, antiproliferative, antioxidant, anti-microbial, hemolytic activity, anti-lipoxygenase, and acetylcholinesterase inhibitory activities. However, more research is needed to validate wound-healing potential and to identify the precise bioactive ingredient contained in Tecoma stans that might be employed in weed management. This could be accomplished by the use of isolation of constituents and screening models.

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