An Updated Overview on Pharmacognostical and Pharmacological Screening of *Tecoma Stans*

K. Gopalasathees Kumar*, T. Boopathi
KMCH college of Pharmacy,
Coimbatore, Tamil Nadu, India
gskpungai@gmail.com

ABSTRACT

The using of natural plants in treatment purposes are the nowadays most familiar than synthetic products because synthetic drugs can cause many of the side effects and the adverse effect. The *Tecoma stans* are one of the plants which are available in most of the tropical countries. In this plant is already used in the traditional medicine in some of the countries like India, Pakistan, etc., this plant belongs to the family of *Bignoniaceae*. This plant is having the many of the active chemical constituents and pharmacological effects. Many of the researchers are studied the pharmacological screening and the current research is going in that plant. The aim of this review was the updated research collections of this plant for its pharmacological screening. The review the on various researchers like pharmacognostical study and the *in vitro* and *in vivo* screening of various parts of *Tecoma stans*. In this review was concluded that the various parts of the plants are having various pharmacological actions like anti-inflammatory, analgesic, anticancer cardio-protective effect, genotoxic, cytotoxicity, wound healing, anti-hyperglycemic, protect CNS, gastric ulcer healing, antiproliferative, antioxidant, anti-microbial, hemolytic activity, anti-lipoxygenase and acetyl-cholinesterase inhibitory activities. And this review was used to develop the future research on this plant.

Key Words: *Tecoma stans*, pharmacology, pharmacognostical, anti-microbial, anti-cancer, anti-diabetic.

INTRODUCTION

The use of natural components for therapeutic properties is earliest as human evolution and, for a long time, plant, mineral, and animal produces the main foundations of drugs. In current years, there has been increasing attention in alternative treatments and the healing use of natural products, particularly those derived from plant life. (Divya *et al*., 2014, Boopathi *et al*., 2017, Sunita *et al*., 2016) This attention in drugs of plant source is due to numerous explanations, namely, conventional medicine can be unsuccessful (e.g. side effects, adverse effects and ineffective therapy), offensive or improper use of synthetic drugs result in side effects and other complications. The Indian sub-continent encompassing of the nation's India, Pakistan, and Bangladesh is the site of one of the eldest evolutions, and it has seen the growth of many traditional healthcare methods. Their growth was maintained by the great biodiversity in plants and biota due to differences in geography and weather. The *Bignoniaceae* family including of about 110 types and 650 species is a family of flowering plants, normally identified as the Jacaranda family, Trumpet Creeper family, Bignonia family, or the Catalpa family. Plant species belonging to this family are dispersed universal, but most of them occur in the tropical and sub-tropical countries. However, a number of moderate species also grow in North America and East Asia. Although the family is small, the *Bignoniaceae* plants are significant for their stated bio-active ingredients and diverse pharmacological activities. (Anburaj *et al*., 2016, Raju *et al*., 2011) *Bignoniaceae* family plants are also extensively used in traditional therapeutic systems of a number of kingdoms, where traditional and tribal medicinal practitioners use a number of species for an action of diverse illnesses. This review purpose is the pharmacognostical, phytochemical profiles and therapeutic potential of different parts of *Tecoma stans*. (Sunitha *et al*., 2016)

Description of *Tecoma stans*

Tecoma stans are the belongs to the family of *Bignoniaceae* that is having many synonyms and common names. Synonyms of *Tecoma stans* are,

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Bignonia stans, Stenolobium stans, Gelseminum stans, Kuntze Seem and Common names are Yellow Bells, Yellow Trumpet Bush, Ginger-Thomas, Yellow Elder and Esperanza. This plant is the official flower for US Virgin Islands and home flower of the Bahamas. *Tecoma stan* is a small tree, 5-8 m in height. The bark of the plant is pale brown to grey color; Leaves are conflicting, compound and imparipinnate with 2 to 5 pairs of leaflets and a greater single terminal leaflet.(Thirumal *et al*., 2013, Namde *et al*., 2014) Leaflets are lanceolate, up to 10 cm long, with serrated borders, mid-green above and soft to the touch. At the ends of the divisions, flowers occur in clusters and are trumpet-shaped with 5 round lobes, 6 cm lengthy, pale to bright yellow, with faint orange stripes at the throat. Fruits are narrow, slightly flattened to pointy capsules, up to 20 cm long, comprising many aerial seeds; green when young, pale brown on maturing and remain on the tree in untidy clusters for many months. (Sarfaraj *et al*., 2010)

PHARMACOGNOSTICAL STUDY

In a pharmacognostical study, this plant is undergoing the various preliminary biochemical studies by various literatures. This plant is having the active phytoconstituents which are identified by the G Anburaj *et al*. The preliminary phytochemicals like carbohydrates, glycosides, alkaloids, steroids, Protein& Amino Acid, Tannins, Flavonoids, Saponins, Terpenoids, Fixed oil and fats and Gums and mucilage are the identified by using various phytochemical tests, this plant is showing the positive results of the various parts and the different extract having the different phytoconstituents. (Brahmam *et al*., 2015, Anburaj *et al*., 2016) And the bio-active components are identified by the GC-MS study the results of this study is confirmed the following active constituents present in the *Tecoma stans* Propane, 1,1,3-Triethoxy- 5-Hydroxymethylfurfural, 1'-Hydroxy-4,3'-Dimethyl-bicycle, 9-Oxabicyclo[3.3.1] Nolan-2-One, 1,10-Decanediol, 1,2,3,4,7,7a-Hexahydro-2,4,7-Trimethyl-6H, Tropane, 2-Acetyl-2,3-Methylene-, 5-Undecanol, 2-Methyl, 6-Dodecanol, Silacyclopentane, 1,1-Dimethyl, Cyclobutanecarboxylic Acid, Decyl ester, Propanamide, 3-(1-Piperazinyl)-, Tetradecanoic Acid, Tetradecanoic Acid, Ethyl Ester, 2(4h)-Benzofuranone, 5,6,7,7atetr, L-(+)-Ascorbic Acid 2,6-Dihexadecanoate, Hexadecanoic Acid, Ethyl Ester, N-Nonadecanol-1, 9,12-Octadecadienoic Acid (Z,Z), Ethyl (9z,12z)-9,12-Octadecadien, Octadecanoic Acid, N-Propyl 9,12-Octadecadienoate, 9,12,15-Octadecatrienoic Acid, Ethyl Ester, Octadecanoic Acid, Ethyl Ester and Hexatriacontane. The GC-MS study is identified the compounds by the retention time and the molecular mass of the compounds.(Lakshmi et., 2013, Kamilia *et al*., 2016)

Active constituents with medicinal value of the *Tecoma stans*

- Tetradecanoic acid- Antioxidant, Lubricant, hypercholesterolemia, Cancer-preventive, Cosmetic
- Hexadecanoic Acid, Ethyl Ester- Antioxidant, hypocholesterolemic, Antiandrogenic, hemolytic, Alpha-reductase inhibitor.(Govindappa *et al*., 2011, Sridharan *et al*., 2014)
- l-(+)-Ascorbic acid 2,6-dihexadecanoate- Vitamin C, Antioxidant, Immunomodulator
- N-Nonadecanol-1- Anti-inflammatory, Hypocholesterolemic, Cancer preventive, Hepato-protective, Nematicide, Insectifuge Antihistaminic, Anti-arthritic, Anti-coronary, Antieczemic Antiacne, 5-Alpha-reductase inhibitor Antiandrogenic,
- 9,12-Octadecadienoic Acid (Z, Z)- Hypocholesterolemic, 5-Alpha-reductase inhibitor, Antihistaminic, Insectifuge, Anti-eczemic, Antiacne
- 9,12,15-Octadecatrienoic Acid, (Z, Z, Z)- Hypocholesterolemic, Nematicide Anti-arthritic, Hepatoprotective, Antiandrogenic, Nematicide 5-Alpha-reductase inhibitor, Antihistaminic, Anti-coronary, Insectifuge, Antieczemic, Anticancer
- Octadecanoic acid- Cosmetic, Flavor, Hypocholesterolemic, Lubricant, Perfumery, Propecia, Suppository

PHARMACOLOGICAL SCREENING OF *TECOMA STANS*

The *Tecoma stans* is having the many medicinal properties, the researchers are studied its medicinal properties by the *in vitro* and *in vivo* pharmacological evaluations. The current updates on the pharmacological screening are shown in the table.1 and table.2.

IN VITRO PHARMACOLOGICAL SCREENING OF *TECOMA STANS*

In vitro studies are performed by using particular parts of an organism, for example cells, microorganisms or biological molecules. The *in vitro* studies of the *Tecoma stans* are the shown in the table.1.

Anti-Proliferative Activity

Cancer is an awful sickness which is more than 100 different types and is categorized by uneven proliferation of the cells which required multidimensional approach for its treatment, control, prevention and is a second leading cause of death worldwide. Breast cancer is one of the long-lasting ailments which may familiarity by females (32.1%) throughout her lifetime and is most commonly identified cancer in them.(Indra *et al*., 2010) The *in vitro* antiproliferative activity of the various parts of the *Tecoma stans* is done in the Breast cancer- MCF-7 cell lines by MTT assay. The Stem, Root, Bark and flowers extracts showed significant anti-proliferative action on the cell lines (MCF-7) but extreme action was found to be in extract stem bark of *Tecoma stans*.

Antioxidant Activity

Free radicals are having one or more unpaired electrons produced in pathological cell metabolism. The commonly produced free radicals are hydroxyl, superoxide, peroxyl radicals. These are the radicals are produced by the oxidation process in the system. Antioxidants are the used to secure the human body from reactive oxygen species. Broadcast of numerous bioactive compounds from plants has leads to the detection of new medicinal drug which have effective protection and treatment roles in against different diseases.(Shanmukha *et al*., 2014) The antioxidant activity of the plant is evaluated by the FRAP assay and the APTS, DPPH radical assays. These are the assays are then compared with the standard antioxidant drugs like vitamin C, Vitamin E etc.

Anti-microbial

The microbial infections are the produces the many of the health problems in the world. The using of synthetic antimicrobial drugs and the antibiotics may produce the some of the adverse effects so that the using of plant source as the antimicrobial agents is important to healing of microbes. In the plant extracts are undergoes the antimicrobial assays by disc diffusion method and the agar medium and minimum inhibitory concentration, etc., in this method the positive and negative strains of organisms and fungal strains are used to the microbial growth and this is inhibited by the adding of the drugs the zone of inhibition was measured and compared with the standard and determination of the antimicrobial activity.

Hemolytic activity

Hemolysis is the process of damage cytoplasmic membrane and producing cell lysis and death. The hemolytic activity is determined by the following procedure. Human blood of different groups (A, B, O) is collected from healthy volunteers in tubes containing heparin anticoagulant. And centrifuged at 3,000 rpm for 3 minutes and the hRBCs were collected. The cells are washed with PBS solution repeated until the supernatant was colorless. The hemolytic assay was performed in a microwell plate. The PBS is filled in each well. And wells added with ABCs. The serially diluted peptide solutions are added in the suitable wells. The hRBCs is used as negative control and hRBCs in Triton is used positive control. Then incubated for 1hour, the button formation of the wells is observed.(Amad *et al*., 2012)

Anti-Lipoxygenase activity

Anti-Lipoxygenase activities are studied by using enzyme-substrate complex concept. In this study linoleic acid (substrate) and lipoxidase (enzyme). Test drugs are dissolved in borate buffer pH 9.0 and added lipoxidase enzyme solution and incubated for 5 min at 250C. After incubation added with the linoleic acid solution, mixed well and absorbance was measured. (Kameshwaran *et al*., 2014) Standard drug indomethacin was used. A dose-response curve was designed to decide the IC50 values.

Xanthine oxidase assay

Xanthine oxidase is the one of enzyme generates the reactive oxygen species. These are the xanthine oxidase are inhibited by some of the drugs and the determination of the inhibitory action of xanthine oxidase by xanthine oxidase assay. This assay was

performed by the following procedure. Xanthine oxidase assay was evaluated spectrophotometrically. In this study the mixture of xanthine, xanthine oxidase and extract with phosphate buffer are incubated in a cuvette. The activity enzyme was articulated as the increase in absorption at 300 nm per unit time.

Acetylcholinesterase Inhibitory activity

A cholinesterase or choline esterase is the enzymes which hydrolysis the acetylcholine to choline and acetate. These are the enzymes are inhibited by the choline esterase inhibitors, the acetylcholine enzyme inhibitors activity was performed by the following method. The AChE inhibitory assay was performed by the following procedure. The mixing of Tris-HCl, BSA buffer, extracts liquefied in buffer-methanol and Acetyl-cholinesterase.(Govindappa *et al*., 2011) The above mixture was then incubated at room temperature for 2 min before the added with DTNB (5,5 Vdithiobis [2-nitrobenzoic acid], substrate acetylthiocholine iodide (ATCI). The development of yellow color was measured at 405 nm after 4 min.

Table 1: *in vitro* screening of *Tecoma stans* with current updates

s. no	Activity	Part of the plant	Type of extract	Method	Main materials	Evaluation parameters	Reference
1	Anti-Proliferative Activity	root, stem bark and flowers	ethanol (60°C) by using a Soxhlet apparatus	MTT Assay	Breast cancer-MCF-7 cell lines, Fetal bovine serum (FBS), penicillin (100 U/ml), and streptomycin	Cell viability (%), Cell death (%)	Thirumal *et al*., 2013
2	Antioxidant Activity	leaves	methanol, ethanol, ethyl acetate, and water	DPPH radical scavenging activity	2,2-diphenyl-2-picrylhydrazyl hydrate (DPPH), ascorbic acid	% scavenging activity	Minal Wani *et al*., 2014
3	Antimicrobial and antioxidant	leaves	Hydro-distillation in a Clevenger apparatus	Disc diffusion method, The Minimum Inhibitory Concentration (MIC), DPPH radical scavenging activity	Two-gram +ve bacteria and two gram –ve bacteria, Fungi, Amphotericin B. DPPH, vitamin E	the diameter of zones of inhibition, % scavenging activity	Kamilia *et al*., 2016
4	Antimicrobial, Antioxidant		ethanol, methanol, and water	Paper disc method, FRAP assay, DDPH radical assay	Two Gram positive bacteria, six Gram-negative bacteria, Fungi, Chlorampheni	Diameter of zone of inhibition, % scavenging activity	Govindappa *et al*., 2011

					col, carbendazim, FRAP reagents, DPPH, L-ascorbic acid and BHT		
5	Antifungal and hemolytic activities	powered	chloroform and 70% ethanol	Drop diffusion method, Minimum Inhibitory Concentration method, Hemolytic Test	Fungi, Ketoconazole,	zone of inhibition	Ramesh *et al*., 2009
6	Anti-Inflammatory, Lipoxygenase, Xanthine Oxidase And Acetylcholinesterase Inhibitory	powder	ethanol, methanol, and water	Alpha-reductase of albumin denaturation, Membrane stabilization test, Xanthine oxidase assay	Trypsin, the lipoxidase enzyme, xanthine oxidase, Aspirin, Acetyl-thiocholine iodide	Percentage inhibitory activities,	Govindappa *et al*., 2011
7	Insecticidal	leaves	Methanol, water, Petroleum ether, Chloroform	Anti-Feedant Properties, Repellant Action	maize weevil, Beans weevil, Sugar	Percentage mortality rate	Tas *et al*., 2015
8	Antimicrobial	heartwood	water, ethanol, methanol	Paper disc method	bacteria and fungi, chloramphenicol, carbendazim	Zone of inhibition (in mm)	Kottai *et al*., 2012
9	Antibacterial	Roots	Methanol	Agar cup plate method	Bacteria, Ciprofloxacin	Zone of inhibition	Ramesh *et al*., 2009
10	Antibacterial	leaves	acetone, ethanol, chloroform, Diethyl ether and ethyl acetate	single disc diffusion method	Bacteria	Zone of inhibition	Subalakshmi *et al*., 2017
11	Antimicrobial	leaves	Ethanol,	agar	Bacterial and	Zone of	Boopathi *et*

			petroleum ether	diffusion method	fungal strain,	inhibition	*al*., 2017
12	Antioxidant And Antimicrobial	flowers	ethanol	DPPH radical scavenging assay, β –carotene bleaching assay, Reducing power assay, agar-well diffusion method.	β-carotene-linoleic acid, DPPH, potassium ferrocyanide, ferric chloride, bacterial and fungal strain	Scavenging effect (%), Zone of inhibition	Rajamuruga n *et al*., 2013
13	antimicrobial	bark	Ethanol, water	Disc diffusion method	Bacterial and fungal strain Tetracycline, ampicillin	Zone of inhibition	Anburaj *et al*., 2016
14	antibacterial activity	leaves	n-hexane		bacterial strains, Amikacin, Ampicillin	Zone of Inhibition (mm)	Sundas *et al*., 2016
15	Antioxidant	heartwood	water, ethanol, and methanol	FRAP assay, DPPH activity	FRAP reagents, DPPH, L-ascorbic acid and BHT	Scavenging effect (%),	Kottai Muthu *et al*., 2012
16	antimicrobial	leaves	water	agar disc diffusion method	Bacterial strains	Zone of inhibition (mm)	Senthilkum ar *et al*., 2010

IN VIVO PHARMACOLOGICAL SCREENING OF TECOMA STANS

In vivo are the effects of various drugs are tested on whole, living organisms or cells, generally animals, including humans, and plants. The *in vivo* studies of the *Tecoma stans* are shown in Table.2.

Anti-inflammatory Activity

Inflammation is formed by the tissue reaction to infection, foreign substances or irritation. The inflammation process is important in the healing of wounds. Several mechanisms are involved in the inflammatory reactions such as the release of histamine, bradykinin, and prostaglandins. The anti-inflammatory drugs are the used to prevent the inflammation. (Gharib *et al*., 2007, Das *et al*., 2010) These are the anti-inflammatory drugs are screened by the *in vivo* animal models and determination of the activity of the drug by the comparison with the standard and control groups.

Central Analgesic Activity

Pain is the symptom of numerous illnesses needful action with analgesics. The analgesic activity is the relives the pain symptom. These are the drugs are then screened by the *in vivo* animal models like HAFFNER's tail clip method in mice, Tail flick or other radiant heat methods, Tail immersion tests, Hotplate methods in mice or rats, Electrical stimulation, Monkey shock titration and Formalin test in rats.(Mohamed *et al*., 2016)

Anticancer

The cancer cells are the having the properties of Uncontrolled growth, tissue invasion, and distinct metastasis. The Chemotherapy is used for the treatment of cancer, but they are greatly toxic, and

the negligible quantity of injected drug only can reach the cancerous tissue, may damage the normal system particularly bone marrow, epithelial tissue, reticuloendothelial system, and gonads. Now a day the plant medicine is the used to the treatment of cancer, the *Tecoma stans* are having the anti-cancer activity and which is evaluated by the WETS on survival time in the animal model.

Cardio-protective effect

Cardiovascular diseases (CVD) cause death in many countries. Myocardial infarction is the imbalance oxygen supply to the myocardium followed by the development of myocardial necrosis. The increased the toxic reactive oxygen species (ROS) such as O2-, H2O2, OH- etc. exerts simple oxidative pressure on myocardium prompting to CVD, for example, ischemic heart disease, atherosclerosis, congestive heart. The *Tecoma stans* are having the cardioprotective effect which is screened by the animal model and estimation of the antioxidant activities of the myocardium.

Genotoxic study

Genotoxicity is the property of chemical substances that damage the genetic information within a cell causing mutations, lead to cancer. All mutagens are genotoxic, but not all the genotoxic substances are mutagenic. The *Tecoma stans* plant is undergoing the genotoxic study and shown in table.2.

Cytotoxicity study

Cytotoxicity is toxic to cells. The cytotoxicity of *Tecoma stans* in human hepatoblastoma was determined by incubating the cells up to 72-hours and changing with concentrations of herbal extracts. Toxic effects of *Tecoma stans* were originated to be attentiveness and time-dependent in the presence and absence of fetal bovine serum.

Wound healing activity

Wound healing is the processes of growth and regeneration of wound tissue. The aim of wound repair is to promote wound healing in the shortest time possible, with least pain, discomfort, and scarring to the patient. Some medicinal plants are used in traditional medicine for wound healing. The *in vivo* study of the wound healing by the various wound animal models and compare with the standard group and control.

Anti-hyperglycemic

Diabetes mellitus is an endocrine syndrome which mostly increases glucose level in the blood due to the defect in the insulin secretion or insulin action or both. In diabetes, the defect in the pancreas islet cells followed by insulin deficiency and causes diabetes. The anti-diabetic drugs are the used to the treatment of diabetes, these are the drugs are screened by the diabetic animal models such as chemical induced diabetes model, genetic induced, hormone induced and the viral-induced animal models. The parameters like glucose level were measured in this model. The *Tecoma stans* having the anti-diabetic activity which is evaluated by the chemical induced diabetes model.

Protect CNS against Oxidative Damages

The specific receptor binding of three neurotransmitters: GABA, an inhibitory transmitter and acetylcholine and glutamate. The oxidative effect produces the free radicals in the neurotransmitters and followed by causes of CNS. Anti-oxidative substances are protected central nervous system from oxidative effect. Recent studies are used herbal extracts as anti-oxidative agents; the *Tecoma stans* are having this property and protect the CNS.

Gastric Ulcer Healing Activity

Gastric ulcers are the erosion of the gastric mucosa in the gastrointestinal tract. There are many factors can induce the ulcer like stress, alcohol, drugs, etc., numerous drug classes are used to the treatment of gastric ulcers, such as proton pump inhibitors, M1-receptor blockers, and H2-receptor antagonists. The anti-ulcer drugs are screened by the various animal models. These are the animal models are the ulcer induced animal models there are many induction methods are available like stress, alcohol, and drugs (paracetamol). The measurement of the ulcer index and the histopathological studies by the determination of the activity and compared with control and standard groups.

Table 2: *In vivo* screening of *Tecoma stans* with current updates

s.no	Activity	Part of the plant and extract solvent	Animals model	Animal used	Standard drug	Evaluation parameters	Reference
1	Anti-inflammatory	Ethanol/ Flower	Carrageenan-Induced Paw Oedema	Wistar rats of either sex (180-250gms)	Indomethacin does 20mg/kg s.c.,	the volume of the paw (using Digital plethysmometer)	Brahmam *et al*., 2015
2	Central Analgesic Activity	Ethanol, Aqueous / Flower	Hot plate method	Swiss albino mice of either sex (25-30gms)	Pentazocin, 10 mg/kg, i.p.)	licking of paws, shaking or jumping off the surface (Eddy's hot plate)	Brahmam *et al*., 2015
3	Antinociceptive activity and Anti-inflammatory activity	Alcohol and Water/ Leaves	Hot plate method, Formalin-induced paw licking model, Acetic acid induced writhing test, Carrageenan-induced rat paw edema,	Albino mice and Wister rats of either sex (weighing g 18-24 g, 150-200 g	Pentazocine(10 mg/kg)., i.p, Pentazocine (10mg/kg) i.p. Diclofenac sodium (10 mg/kg, p.o.	licking of paws, shaking or jumping off the surface (Eddy's hot plate), %inhibition of Paw licking, % inhibition of writhing response. % inhibition of paw edema Inflammation	Lakshmi *et al*., 2013
4	Anticancer	Water/aerial parts	WETS on survival time	Swiss albino mice	5- Fluorouracil (20mg/kg.bw.)	Tumor volume, Tumor cell count, and Viable and non-viable cell counts	Sridharan *et al*., 2014
5	Cardio-protective effect	Ethanol/ Flowers	isoproterenol-induced myocardial infarction	Wister rats (150-250g)	Simvastatin (60 mg/kg)p.o	ALT, AST, LDH, CK, TC, TG, LDL and depletion of HDL levels GSH, lipid peroxidation SOD, and CAT,	Shanmukha *et al*., 2014
6	Genotoxic and cytotoxic	Water/Leaves	Bone marrow chromosome assay, Mitotic index assay, Chromosome	Male BALB/c mice (22-24g)		Mitotic index, Chromosome abbreviation, Percentage inhibition of MEF	Amad M *et al*., 2012

			abbreviation assay, Mouse embryo fibroblast, Viable cell count				
7	Wound healing	Ethanol/ Flowers	Excision wound model, Incision wound model, Burn wound model	Wister albino rats (150-180g)	Silver sulfadiazine (0.01%)	Percentage wound concentration, Epithelialization period, Tensile strength, Hydroxyproline, Histo-pathological study	Kameshwaran *et al*., 2014
8	Wound healing	Petroleum ether, Chloroform, Methanol/ Bark	Excision wound, Incision wound	Wister albino rats (180-250g)	Vaseline, 2% gum acacia suspension (1 ml/kg,p.o).	Percentage wound concentration, Epithelialization period	Das *et al*., 2010
9	Anti-cancer	Methanol/ Flowers	Antitumor activity, Hematological parameters.	Male Swiss albino rats (150-180g)	5- Fluorouracil (20mg/kg.bw.)	Tumor volume, Tumor weight, Viable/non-viable cell count, mean survival time, Body weight, food intake	Kameshwaran *et al*., 2012
10	Antispasmodic	Alcohol/ Leaves	Bio-assay	Male adult Wister rats (200-250g)	carbachol, tetraethylammonium, propranolol, naloxone, glibenclamide	Percentage relaxation, Percentage contraction	Gharib *et al*., 2007
11	Anti-hyperglycemic	Methanol/ Leaves	STZ induced diabetes model	albino rats (100-150 g)	metformin hydrochloride(500 mg/kg)	Carbohydrate tolerance curve, TC, TG, HDL, glucose, creatinine, uric acid, ALT levels,	Taher *et al*., 2016
12	Protect CNS	Ethanol/ Flowers	Tail-suspension Test, Forced-swimming Test, Actophotometer	Wistar albino rats (200-300g)	No standard group only control group treated with vehicle	immobility time, locomotors activity	Kameshwaran S*et al*., 2014

13	Gastric Ulcer Healing	Petroleum ether/ Leaf	Pylorus Ligation Induced Ulcers	Wister albino rats (150-180g)	Ranitidine	Volume of Gastric juice ml, pH, Free acid (meq/l), Ulcer score %	Arnabadity a *et al*., 2012
14	Hepatoprotective	Petroleum ether, Chloroform, Ethanol/Leaves	Thioacetamide induced hepatotoxicity, CCL4 induced nephrotoxicity	Wistar albino rats (150-250g)	Silymarin 100 mg/kg p.o.,.	liver weight, liver volume, biochemical markers, GSH, lipid peroxidation levels,	Shanmukh a *et al*., 2013
15	Nephroprotective	Petroleum Ether, Chloroform, Ethanol, Water/ Leaves	Cisplatin-induced nephrotoxicity in rats, Gentamicin-induced nephrotoxicity in rats, Paracetamol-induced nephrotoxicity in rats	Wister albino rats (weighing 150-250g) and albino mice (weighing 20-25g)	saline 1ml/kg p.o	blood urea, serum creatinine, kidney weight, GSH levels, body weight, lipid peroxidation levels	Shanmukh a *et al*., 2012

CONCLUSION

Tecoma stans are having the many of the active phytoconstituents which are leads to the great medicinal value of this plant. In this review was concluded that the various parts of the plants are having various pharmacological actions like anti-inflammatory, analgesic, anticancer cardio-protective effect, genotoxic, cytotoxicity, wound healing, anti-hyperglycemic, protect CNS, gastric ulcer healing, antiproliferative, antioxidant, anti-microbial, hemolytic activity, anti-lipoxygenase and acetyl-cholinesterase inhibitory activities. And this review was used to develop the further research in this plant *Tecoma stans*.

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