An Updated Overview on Pharmacognostical and Pharmacological Screening of Tecoma Stans

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ABSTRACT
The use 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,
Bignonia stans, Stenolobium stans, Gelsemium 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 stans 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-Hydroxymethylfurural, 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-Decanol, Silasyclopentane, 1,1-Dimethyl, Cyclobutanecarboxylic Acid, Decyl ester, Propanamide, 3-(1-Piperazinyl)-, Tetradecanoic Acid, Tetradecanoic Acid, Ethyl Ester, 2(4h)-Benzoafuranone, 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-Octadecadien, 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, Kamilla et al., 2016)

Active constituents with medicinal value of the Tecoma stans

- Tetradecanoic acid- Antioxidant, Lubricant, hypercholesterolemia, Cancer-preventive, Cosmetic
- L(+)-Ascorbic acid 2,6-dihexadecanoate- Vitamin C, Antioxidant, Immunomodulator
- N-Nonadecanol-1- Anti-inflammatory, Hypcholesterolemic, Cancer preventive, Hepato-protective, Nematicide, Insectifuge Antihistaminic, Anti-arthritis, Anti-coronary, Antieczemic Antiacne, 5-Alphareductase inhibitor Antiandrogenic,
- 9,12-Octadecadienoic Acid (Z, Z)- Hypcholesterolemic, 5-Alphareductase inhibitor, Antihistaminic, Insectifuge, Anti-eczemic, Antiacne
- Octadecanoic acid- Cosmetic, Flavor, Hypcholesterolemic, 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 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 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-Lipoygenase activity**

Anti-Lipoygenase 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>
<thead>
<tr>
<th>s. no</th>
<th>Activity</th>
<th>Part of the plant</th>
<th>Type of extract</th>
<th>Method</th>
<th>Main materials</th>
<th>Evaluation parameters</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Anti- Proliferative Activity</td>
<td>root, stem bark and flowers</td>
<td>ethanol (60°C) by using a Soxhlet apparatus</td>
<td>MTT Assay</td>
<td>Breast cancer-MCF-7 cell lines, Fetal bovine serum (FBS), penicillin (100 U/ml), and streptomycin</td>
<td>Cell viability (%), Cell death (%)</td>
<td>Thirumal et al., 2013</td>
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<tr>
<td>2</td>
<td>Antioxidant Activity</td>
<td>leaves</td>
<td>methanol, ethanol, ethyl acetate, and water</td>
<td>DPPH radical scavenging activity</td>
<td>2,2-diphenyl-2-pircylylhydrazyl hydrate (DPPH), ascorbic acid</td>
<td>% scavenging activity</td>
<td>Minal Wani et al., 2014</td>
</tr>
<tr>
<td>3</td>
<td>Antimicrobial and antioxidant</td>
<td>leaves</td>
<td>Hydro-distillation in a Clevenger apparatus</td>
<td>Disc diffusion method, The Minimum Inhibitory Concentration (MIC), DPPH radical scavenging activity</td>
<td>Two-gram +ve bacteria and two gram –ve bacteria, Fungi, Amphotericin B. DPPH, vitamin E</td>
<td>the diameter of zones of inhibition, % scavenging activity</td>
<td>Kamilia et al., 2016</td>
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<tr>
<td>4</td>
<td>Antimicrobial, Antioxidant</td>
<td>ethanol, methanol, and water</td>
<td>Paper disc method, FRAP assay, DPPH radical assay</td>
<td>Two Gram positive bacteria, six Gram-negative bacteria, Fungi, Chlorampheni</td>
<td>Diameter of zone of inhibition, % scavenging activity</td>
<td>Govindappa et al., 2011</td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Activity Type</td>
<td>Plant Part</td>
<td>Solvent Combinations</td>
<td>Method</td>
<td>Microorganisms Tested</td>
<td>Results</td>
<td>Reference</td>
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<td>5</td>
<td>Antifungal and hemolytic activities</td>
<td>Powered</td>
<td>chloroform and 70% ethanol</td>
<td>Drop diffusion method, Minimum Inhibitory Concentration method, Hemolytic Test</td>
<td>Fungi, Ketoconazole,</td>
<td>zone of inhibition</td>
<td>Ramesh et al., 2009</td>
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<td>6</td>
<td>Anti-Inflammatory, Lipoxygenase, Xanthine Oxidase And Acetylcholinesterase Inhibitory</td>
<td>Powder</td>
<td>ethanol, methanol, and water</td>
<td>Alpha-reductase of albumin denaturatio n, Membrane stabilization test, Xanthine oxidase assay</td>
<td>Trypsin, the lipoxidase enzyme, xanthine oxidase, Aspirin, Acetyl-thiocholine iodide</td>
<td>Percentage inhibitory activities</td>
<td>Govindappa et al., 2011</td>
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<td>7</td>
<td>Insecticidal</td>
<td>Leaves</td>
<td>Methanol, water, Petroleum ether, Chloroform</td>
<td>Anti-Feedant Properties, Repellant Action</td>
<td>maize weevil, Beans weevil, Sugar</td>
<td>Percentage mortality rate</td>
<td>Tas et al., 2015</td>
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<td>8</td>
<td>Antimicrobial</td>
<td>Heartwood</td>
<td>water, ethanol, methanol</td>
<td>Paper disc method</td>
<td>bacteria and fungi, chloramphenicol, carbendazim</td>
<td>Zone of inhibition (in mm)</td>
<td>Kottai et al., 2012</td>
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<td>9</td>
<td>Antibacterial</td>
<td>Roots</td>
<td>Methanol</td>
<td>Agar cup plate method</td>
<td>Bacteria, Ciprofloxacin</td>
<td>Zone of inhibition</td>
<td>Ramesh et al., 2009</td>
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<td>10</td>
<td>Antibacterial</td>
<td>Leaves</td>
<td>acetone, ethanol, chloroform, Diethyl ether and ethyl acetate</td>
<td>single disc diffusion method</td>
<td>Bacteria</td>
<td>Zone of inhibition</td>
<td>Subalakshm i et al., 2017</td>
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<td>11</td>
<td>Antimicrobial</td>
<td>Leaves</td>
<td>Ethanol, agar</td>
<td></td>
<td>Bacterial and</td>
<td>Zone of</td>
<td>Boopathi et</td>
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</table>

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<table>
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<th>No.</th>
<th>Activity Type</th>
<th>Plant Part</th>
<th>Extraction Solvent</th>
<th>Assay Method</th>
<th>Inhibitor Assay</th>
<th>Scavenging Effect (%)</th>
<th>Zone of Inhibition (mm)</th>
<th>Reference Authors, Year</th>
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<tr>
<td>12</td>
<td>Antioxidant And Antimicrobial</td>
<td>flowers</td>
<td>petroleum ether</td>
<td>DPPH radical scavenging assay, β-carotene-linoleic acid, DPPH, potassium ferrocyanide, ferric chloride, bacterial and fungal strain</td>
<td>Scavenging effect (%)</td>
<td>Zone of inhibition</td>
<td></td>
<td>Rajamurugan et al., 2013</td>
</tr>
<tr>
<td>13</td>
<td>Antimicrobial</td>
<td>bark</td>
<td>Ethanol, water</td>
<td>Disc diffusion method</td>
<td>Bacterial and fungal strain Tetracycline, ampicillin</td>
<td>Zone of inhibition</td>
<td></td>
<td>Anburaj et al., 2016</td>
</tr>
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<td>14</td>
<td>Antibacterial activity</td>
<td>leaves</td>
<td>n-hexane</td>
<td></td>
<td>bacterial strains, Amikacin, Ampicillin</td>
<td>Zone of Inhibition (mm)</td>
<td></td>
<td>Sundas et al., 2016</td>
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<tr>
<td>15</td>
<td>Antioxidant</td>
<td>heartwood</td>
<td>water, ethanol, and methanol</td>
<td>FRAP assay, DPPH activity</td>
<td>FRAP reagents, DPPH, L-ascorbic acid and BHT</td>
<td>Scavenging effect (%)</td>
<td></td>
<td>Kottai Muthu et al., 2012</td>
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<tr>
<td>16</td>
<td>Antimicrobial</td>
<td>leaves</td>
<td>water</td>
<td>agar disc diffusion method</td>
<td>Bacterial strains</td>
<td>Zone of inhibition (mm)</td>
<td></td>
<td>Senthilkumar et al., 2010</td>
</tr>
</tbody>
</table>

**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 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

<table>
<thead>
<tr>
<th>s.n</th>
<th>Activity</th>
<th>Part of the plant and extract solvent</th>
<th>Animals model</th>
<th>Animal used</th>
<th>Standard drug</th>
<th>Evaluation parameters</th>
<th>Reference</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Anti-inflammatory</td>
<td>Ethanol/Flower</td>
<td>Carrageenan-Induced Paw Oedema</td>
<td>Wistar rats of either sex (180-250gms)</td>
<td>Indomethacin does 20mg/kg s.c.,</td>
<td>the volume of the paw (using Digital plethysmometer)</td>
<td>Brahmam et al., 2015</td>
</tr>
<tr>
<td>2</td>
<td>Central Analgesic Activity</td>
<td>Ethanol, Aqueous/Flower</td>
<td>Hot plate method</td>
<td>Swiss albino mice of either sex (25-30gms)</td>
<td>Pentazocine, 10 mg/kg, i.p.)</td>
<td>licking of paws, shaking or jumping off the surface (Eddy’s hot plate)</td>
<td>Brahmam et al., 2015</td>
</tr>
<tr>
<td>3</td>
<td>Antinociceptive activity and Anti-inflammatory activity</td>
<td>Alcohol and Water/Leaves</td>
<td>Hot plate method</td>
<td>Albino mice and Wistar rats of either sex (weighing 18-24 g, 150-200 g)</td>
<td>Pentazocine(10 mg/kg), i.p., Pentazocine (10mg/kg) i.p. Diclofenac sodium (10 mg/kg, p.o.)</td>
<td>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</td>
<td>Lakshmi et al., 2013</td>
</tr>
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<td>4</td>
<td>Anticancer</td>
<td>Water/aerial parts</td>
<td>WETS on survival time</td>
<td>Swiss albino mice</td>
<td>5- Fluorouracil (20mg/kg,bw.)</td>
<td>Tumor volume, Tumor cell count, and Viable and non-viable cell counts</td>
<td>Sridharan et al., 2014</td>
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<td>5</td>
<td>Cardio-protective effect</td>
<td>Ethanol/Flowers</td>
<td>isoproterenol-induced myocardial infarction</td>
<td>Wister rats (150-250g)</td>
<td>Simvastatin (60 mg/kg)p.o</td>
<td>ALT, AST, LDH, CK, TC, TG, LDL and depletion of HDL levels GSH, lipid peroxidation SOD, and CAT,</td>
<td>Shanmukha et al., 2014</td>
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<td>6</td>
<td>Genotoxic and cytotoxic</td>
<td>Water/Leaves</td>
<td>Bone marrow chromosome assay, Mitotic index assay, Chromosome</td>
<td>Male BALB/c mice (22-24g)</td>
<td>Mitotic index, Chromosome abbreviation, Percentage inhibition of MEF</td>
<td></td>
<td>Amad M et al., 2012</td>
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<td>Abbreviation</td>
<td>Assay, Description</td>
<td>Experimental Model</td>
<td>Treatment</td>
<td>Outcome Parameters</td>
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<td>Wound healing</td>
<td>Ethanol/Flowers</td>
<td>Excision wound model, Incision wound model, Burn wound model</td>
<td>Wister albino rats (150-180g)</td>
<td>Silver sulfadiazine (0.01%)</td>
<td>Percentage wound concentration, Epithelialization period, Tensile strength, Hydroxyproline, Histo-pathological study</td>
<td>Kameshwaran et al., 2014</td>
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<td>Wound healing</td>
<td>Petroleum ether, Chloroform, Methanol/Bark</td>
<td>Excision wound, Incision wound</td>
<td>Wister albino rats (180-250g)</td>
<td>Vaseline, 2% gum acacia suspension (1 ml/kg,p.o.)</td>
<td>Percentage wound concentration, Epithelialization period</td>
<td>Das et al., 2010</td>
<td></td>
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<tr>
<td>Anti-cancer</td>
<td>Methanol/Flowers</td>
<td>Antitumor activity, Hematological parameters.</td>
<td>Male Swiss albino rats (150-180g)</td>
<td>5-Fluorouracil (20mg/kg,bw.)</td>
<td>Tumor volume, Tumor weight, Viable/non-viable cell count, mean survival time, Body weight, food intake</td>
<td>Kameshwaran et al., 2012</td>
<td></td>
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<tr>
<td>Antispasmodic</td>
<td>Alcohol/Leaves</td>
<td>Bio-assay</td>
<td>Male adult Wister rats (200-250g)</td>
<td>Carbachol, tetraethylammonium, propranolol, naloxone, glibenclamide</td>
<td>Percentage relaxation, Percentage contraction</td>
<td>Gharib et al., 2007</td>
<td></td>
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<tr>
<td>Anti-hyperglycemic</td>
<td>Methanol/Leaves</td>
<td>STZ induced diabetes model</td>
<td>Albino rats (100-150g)</td>
<td>Metformin hydrochloride(500mg/kg)</td>
<td>Carbohydrate tolerance curve, TC, TG, HDL, glucose, creatinine, uric acid, ALT levels</td>
<td>Taher et al., 2016</td>
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<tr>
<td>Protect CNS</td>
<td>Ethanol/Flowers</td>
<td>Tail-suspension Test, Forced-swimming Test, Actophotometer</td>
<td>Wistar albino rats (200-300g)</td>
<td>No standard group only control group treated with vehicle</td>
<td>Immobility time, locomotors activity</td>
<td>Kameshwaran Set al., 2014</td>
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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-lipooxygenase and acetyl-cholinesterase inhibitory activities. And this review was used to develop the further research in this plant _Tecoma stans_.

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