A PHYTOCHEMICAL EVALUATION AND REVIEW ON
PHARMACOLOGICAL STUDY OF CALOTROPIS GIGANTEA

Ajay Kumar Ramdev Jaiswar*

Final Year B. Pharmacy of Shree Anagarsiddha Shikshan Prasarak Mandal’s
ASPM College of Pharmacy, Sangulwadi, Vaibhavawadi, Sindhudurg, Maharashtra.
Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad, Maharashtra.

ABSRACT
Calotropis gigantea (Asclepiadaceae) is a perennial herb with a long
history of use in traditional medicines. A wide range of chemical
compounds including cardiac glycosides, flavonoids, terpenoids,
alkaloids, tannins, & resins has been isolated from this plant. The plant
has been used for various disease condition including leprosy, ulcers,
tumors and piles. Various pharmacological activities reported like
analgesic activity, antipyretic activity, pregnancy interceptive activity,
CNS activity, anti-inflammatory activity, procoagulant activity,
antidiarrhoeal activity, free radical scavenging activity, antimicrobial
activity, anti-tumor activity, antifungal activity, antitussive activity,
and antifeedant activity. Calotropis gigantea contain many biologically active
phytoconstituent group like cardenolides, calotnaphthalaene, steroids, tannins, glycosides,
phenols, terpenoids, sugars, flavonoids, alkaloids and saponins in different part of plant
including stem, root, leaves, flower etc. This plant is well-known because it generates a lot of
latex. Many proteins, glycosides, tannins, and other physiologically active substances can be
found in latexes. External swellings and diarrhoea are treated using the plant's leaves and
aerial portions. The following provides the systematic position, common names, and
vegetative characteristics of the plant. The objective of this study is to analyse the
phytochemical composition of C. gigantea.

KEYWORDS: Calotropis gigantea, Phytoconstituent, Chemical compounds, Herbal plant.
INTRODUCTION

Any plant that has a component that can be utilised for therapeutic purposes or that serves as a precursor for the manufacture of valuable pharmaceuticals is considered to be a medicinal plant. The term "Medicinal Plants" often refers to plants that have healing qualities or have positive pharmacological effects on animal bodies. It is now known that plants with secondary metabolites such as alkaloids, glycosides, tannins, volatile oils, and vitamins and minerals spontaneously synthesise and accumulate these compounds have therapeutic potential. Vitamins, minerals, proteins, carbohydrates, essential oils, tannins, alkaloids, bitters, and flavonoids are just a few of the beneficial components found in plants. Each component of the plant has unique qualities and serves a variety of functions.[1] Plants belonging to the Asclepiadaceae family have a wide range of therapeutic activities. Calotropis gigantea contain many biologically active phytoconstituent group like cardenolides, Calotnaphthalaene, steroids, tannins, glycosides, phenols, terpenoids, sugars, flavonoids, alkaloids and saponins in different part of plant including stem, root, leaves, flower etc. This plant is well-known because it generates a lot of latex.[12] Many proteins, glycosides, tannins, and other physiologically active substances can be found in latexes. External swellings and diarrhoea are treated using the plant's leaves and aerial portions. According to reports, latex has purgative qualities that promote wound healing. C. gigantea is a significant medicinal plant that was utilised to test the plant's phytochemical composition and in vitro antibacterial activity.[5] The plants Calotropis gigantea and Calotropis procera both of them have similar pharmacological effects and frequently share botanical characteristics. It show many pharmacological effects such as antimicrobial, anthelmintic, anti-inflammatory, analgesic and antipyretic, anticancer, anti-angiogenic, immunological, antidiabetic (hyperglycemia), cardiovascular, hypolipidemic, gastroprotective, dental pain, hepatic protective, renal protective, anti-diarrheal, antioxidant, anticonvulsant, enhancement of wound healing, antifertility and smooth muscle relaxant effect.[6,7]

Common names of calotropis gigantea[7]
Arabic: Dead Sea plant, debaj, usher, oshar, kisher
English: Calotrope, calotropis, Dead Sea fruit, desert wick, giant milkweed, swallow-wort, mudar fibre, rubberbush, rubber tree, sodom apple
French: Pomme de Sodome, algodón de seda, arbre á soie, coton soie, arbre a soie du Senegal
German: Wahre mudarpflanzer, gomeiner
Hindi: Madar, akada, akdo, aak
Italian: Calotropo;
Marathi: Rui, mandara
Punjabi: Ak
Sanskrit: Arka, alaka, ravi
Somali: Boah, bo’ah
Spanish: Bomba, algodón extranjero, cazuela
Swahili: Mpamba mwitu
Tamil: Vellerukku
Telgu: Jilledu
Turkish: Ipekg and
Urdu: Madar, aak

Synonyms
Calotropis gigantea var. procera (Aiton) P.T.Li, Calotropis heterophylla Wall. ex Wight, Calotropis heterophylla Wall., Calotropis inflexa Chiov, Calotropis persica Gand, Calotropis syriaca Woodson, Calotropis wallichii Wight, Madorius procerus (Aiton) Kuntze, Apocynum syriacum Garsault, Asclepias patula Decne, Asclepias procera Aiton and Calotropis busseana K. Schum.¹²

Taxonomic classification: [⁴]
Table no. 1: Taxonomic classification of calotropis gigantean.

<table>
<thead>
<tr>
<th>Sr. no.</th>
<th>Name</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
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</tr>
<tr>
<td>2</td>
<td>Subkingdom</td>
<td>Tracheobionta</td>
</tr>
<tr>
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<td>Superdivision</td>
<td>Spermatophyta</td>
</tr>
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</tr>
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<td>5</td>
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<td>Asteridae</td>
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</tr>
<tr>
<td>8</td>
<td>Family</td>
<td>Asclepiadaceae</td>
</tr>
<tr>
<td>9</td>
<td>Genus</td>
<td>Calotropis</td>
</tr>
<tr>
<td>10</td>
<td>Species</td>
<td>Calotropis procera</td>
</tr>
</tbody>
</table>

Chemical constituents [⁹,¹⁴]
Phytochemical studies on Calotropis have afforded several types of compounds such as Cardenolide, triterpinoids, alkaloids, resins, anthocyanins and proteolytic enzymes in latex, flavonoids, tannins, sterol, saponins, cardiac glycosides. Flowers contain terpenes,
multiflorenol, and cyclisadol.

**Flower**
The flower contains the flavonoids, queretin-3- ratinoside, sterol, calactin, calotoxin, calotropagenin, and calotropin, polysaccharides with D-arabinose, glucose, glucosamine and L-rhamnose. Flowers also contain enzymes 3 proteinase and calotropain (protease). Other chemical constituents of *C. gigantea* flowers are elpeol, uscharin, proceroside, proceragenin (cardenolide), syriogenin, taraxast-20(30)-en-3-(4methyl3pentenoate), 3- thiazoline cardenolide, gigantin, giganteol, isogiganteol, uscharidin, uzarigeninvoruscharin a-calotropeol, 3- epimoretenol, alactuceryl acetate an a-lactuceryl isovalerate.

**Bark**
Root bark of Calotropis containstriterpenes, a new norditerpenyl ester, named Calotropterpenyl ester, and two unknown pentacyclic triterpinoids, namelycalotropursenyl acetate and calotropfriedelenylacetate, akundarol isovalerate and quercetin -3- rutinoside.

**Leaves**
The leaves contain mainly the amyrin, amyrin acetate, ß-sitosterol, urosolic acid, cardenolides, calotropin,calotropagenin.

**Latex**
The latex contains caoutchouc, calotropin, calotoxin 0.15%, calactin 0.15%, uscharin0.45%, trypsin, voruscharin,uzarigenin, syriogenin and proceroside.

**Root**
Calotnaphthalaene (Naphthalenederivates), caltropisesquiterpenol, Caltropisestertepenol (terpenederivaties),calotropbenzofuranone (Aromatic product) and sucrose.

**Seed**
Dil Extracted from seed contain palmitic, oleic, linoleic andlinolenic acid. The unsapnifiable fraction containphytosterol, stigmasterol, melissyl alcohol and laurane.

**Pharmacological effects**[^3,^7,^10,^20]

- Antimicrobial effect
- Antipyretic activity
- Wound healing activity
- Anti-inflammatory activity
- Cardiovascular effect
- Anticancer effect
- Antidiabetic effect
- Analgesic activity
- CNS activity
- Insecticidal activity
- Hepatoprotective effect

**Therapeutic use**[^5,8,6,20]

The plant is purgative, anthelmintic, alexipharmic, cures leprosy, leucoderma, ulcers, tumors, piles, diseases of the spleen, the liver, and the abdomen; the juice is anthelmintic and leucoderma, tumors, ascites, diseases of the abdomen. The leaves are applied to paralyzed parts, painful joints, swellings; heal wounds. The tincture from the leaves used as antiperiodic in cases of intermittent fevers. Inflammations, tumors, rat-bite, good in ascites. The milk is bitter, heating, purgative; Laxative; cures piles. The root bark is diaphoretic; cures asthma and syphilis. The flower is sweet, bitter, anthelmintic, analgesic, astringent, cures.

**Collection of plant material**

The latex, fresh or dried leaves, the flowers were used medicinally. The C. gigantea was gathered from the neighbourhood in the village of sangulwadi in the vaibhavwadi district. The samples were gathered and stored aseptically to the lab in sterile plastic bags. The freshly collected leaves were washed with sterile distilled water and dried in shade at room temperature for 10-15 days. Then the leaves were powdered by using machinal mixer. The finely powdered leaves were used for extraction.

**Extraction process**[^12,13,17,18,19]

**Pre-extraction preparation of plant sample**

The first step of studying medicinal plants is the creation of plant samples to preserve the phytoconstituent in the plants earlier to extraction. Plants material stem are then used for the extraction. The following criteria are essential prior to the extraction.
Selection and Collection of plant materials
The selection and the collection of plant material are important in making efficient phytoconstituent isolation. The disease free and healthy plants only selected for the plant extraction which is protected from weeds and insect. And the numerous factors involved in the collection of the plant materials. NRCS (Natural Resources Conservation Service) Plant Materials Program created the guidelines for the collection of plant material, which includes the collection of seed and vegetative collections. This guideline explains the relevant collection time, collection techniques, processing and storage of plant materials.

Drying of plant materials
The drying process is important for the extraction of plant materials, the fresh plant materials are having the active enzymes which is produces the active constituents intermediates and metabolic reactions in the plant materials, so that the drying is important for the pre-extraction preparation of plant materials. Stem then shade in the dark room because the overheat can losses the volatile substances from plant materials and some of the light sensitive constituents may losses in light condition.

Grinding and Size reduction
Grinding and size reduction is the essential for the soxhlet extraction process because smaller the particle size greater the surface area of the powdered particles. Large surface area improves the contact of the powdered particles with the solvent used for extraction and hence efficient extraction takes place. Mechanical mixer grinder are used for size reduction process.

Size Separation/Sieving
The size separation is important for efficient soxhlet extraction. Uniform powdered particle size provides maximum extraction as the solvent can pass uniformly through the powdered particles packed in the thimble. Th very fine powder and very coarse powders are not suitable for effective extraction. The very fine powder may produce the beds during extraction and very coarse powders delay the extraction process. The size separation is done by the sieving method (sieving mesh size 60)

Solvent for soxhlet extraction
The selection of the solvent for soxhlet extraction is based on the phytoconstituent isolation process. The solvent should be easy to remove and inert. Normally the solvent selection is based on the increasing polarity order like the order of acetone, petroleum ether, ethyl acetate,
chloroform, methanol, ethanol and water. The Active Phytoconstituents are mainly soluble in alcohol, so we extract active constituent by using alcohol and aqueous solvent.

**Ethanolic extraction calotropis gigantea**

The stem of Calotropis gigantea was collected, washed with distilled water and dried in shed. After shed drying the leave cut into the small pieces and grind it in mixer and got fine powder by sieving. By using this fine 10 gm of powder extraction was carried out by 100 ml of ethanol with the help of soxhlet apparatus.

**Aqueous extraction of calotropis gigantea**

The stem of Calotropis gigantea was collected, washed with distilled water and dried in shed. After shed drying the leave cut into pieces and grind it in mixer and got fine powder by sieving. By using this fine 10 gm of powder extraction was carried out by 100 ml of water with the help of soxhlet apparatus.

**Phytochemical screening of caltropis gigantea leaf**[^10][11][13][15][16][17]

**Test for alkaloids:**

In aqueous and alcoholic extracts, dilute HCl was added. Shaken well and filtered. With the filtrate, following tests were performed:

- **Mayer’s test:** 2-3 ml filtrate with few drops of Mayer’s reagent gave ppt.
- **Wagner’s test:** 2-3 ml filtrates with few drops Wagner’s reagent gave reddish brown precipitate.
- **Dragendorff’s test:** To 2-3 ml filtrate, few drops of Dragendorff’s reagent was added. Orange brown ppt was formed.
- **Hager’s test:** 2-3 ml filtrate with Hager’s reagent gave yellow precipitate.

**Test for carboxydrates**

- **Molish’s test (General test):** To 2-3 ml of aqueous extract, few drops of alpha-napthol solution in alcohol was added, shaken and conc. H2SO4 was added from sides of the test tube. Violet ring was formed at the junction of two liquids.

**Tests for reducing sugars**

- **Fehling’s test:** 1 ml Fehling’s A and 1ml Fehling’s B solutions was mixed, boiled for one minute. Equal volume of test solution was added and heated in boiling water bath for 5-10 min. First a yellow, then brick red precipitate was observed.
- **Benedict’s test**: Equal volume of Benedict’s reagent and test solution in test tube was mixed and heated in boiling water bath for 5 min. Solution appeared green, yellow or red depending on amount of reducing sugar present in test solution.

**Tests for monosaccharides**

- **Barfoed’s test**: Equal volume of Barfoed’s reagent and test solution was mixed and heated for 1-2 min. in boiling water bath and cooled. Red precipitate was observed.

**Tests for glycosides**

**Tests for cardiac glycosides**

- **Legal’s test (Test for cardenoloids)**: To aqueous or alcoholic extract, 1 ml pyridine and 1 ml sodium nitroprusside was added. Pink to red colour appeared.

- **Test for deoxysugars (Keller-Killiani test)**: To 2 ml extract, glacial acetic acid, one drop 5% FeCl3 and conc. H2SO4 were added. Reddish brown colour appeared at junction of the two liquid layers and upper layer appeared bluish green.

- **Borntrager’s test for Anthraquinone glycosides**: To 3 ml extract, dil. H2SO4 was added. Boiled and filtered. To cold filtrate, an equal volume of benzene or chloroform was added. Shaken well. The organic solvent was separated. Ammonia was added. Ammonical layer turned pink or red.

**Tests for amino acids**

- **Ninhydrin test (General test)**: Three ml filtrate and 3 drops 5% ninhydrin solution were heated in boiling water bath for 10 min. observed for purple or bluish colour.

**Tests for proteins**

- **Biuret test (General test)**: To 3 ml test solution, 4% NaOH and few drops of 1% CuSO4 solution was added. Violet or pink color appeared.

- **Xanthoprotein test (For protein containing tyrosine or tryptophan)**: To 3 ml test solution was mixed with 1 ml conc. H2SO4. White precipitate was formed. It was then boiled. Precipitate turned yellow. NH4OH was added, precipitate turned orange.

**Test for steroids**

One gram of the test substance (plant extracts) was dissolved in a few drops of acetic acid. It was gently warmed and cooled under the tap water and a drop of concentrated sulphuric acid was added along the sides of the test tube. Appearance of green colour indicates the presence
of Steroids.

Tests for terpenoids

- **Salkowski reaction**: 5ml of each plant part extract was mixed in 2 ml of chloroform, and concentrated H2SO4 (3 ml) was carefully added to form a layer. Formation of reddish brown coloration at the interface shows the positive results for presence of terpenoids.

Tests for Tannins and Phenolic compounds

To 2-3 ml of aqueous or alcoholic extract, few drops of following reagents were added:

- **5% FeCl3 solution**: Deep blue-black colour.
- **Dilute HNO3**: Reddish to yellow colour.

Test for flavonoid

The general flavonoid identification tests were performed on the extract.

- **Test 1**: To dry extract, add 5ml of 95% ethanol, few drop of concentrated hydrochloric acid and 0.5g ofmagnesium turning. The finally pink colour observed. (Shinoda test)
- **Test 2**: To a small quantity of extract, add lead acetate solution, it shows yellow coloured precipitate is formed.

RESULT AND CONCLUSION

Calotropis gigantea is the medicinal plant and having different pharmacological action. It also have different active phytoconstituents present in it. These phytoconstituents can be identified by using various chemical methods of evaluation of the phytoconstituents. From this review it is concluded that the C .Gigantiea leaf contains alkaloid, carbohydrate, glycoside, proteins, amino acid, flavonoids, terpenoids, steroids and tannins.

Table no. 2: Phytochemical screening of caltropis gigantea leaf.

<table>
<thead>
<tr>
<th>Test</th>
<th>Alcoholic Extract</th>
<th>Aqueous Extract</th>
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<tbody>
<tr>
<td>Alkaloids</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Glycoside</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Amino acid</td>
<td>-</td>
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<tr>
<td>Proteins</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Steroids</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Tannins</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Flavonoids</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Terpenoids</td>
<td>+</td>
<td>_</td>
</tr>
</tbody>
</table>

(+= Positive - = Negative)
ACKNOWLEDGEMENT

Presentation, inspiration and motivation have always played a key role in the success of any venture. Well planned efforts in the right direction surely fruitify in success, but efforts are fruitful due to hands making passage smoother. It is a moment of gratification and pride to look back with a sense of contentment at the long travelled path, to be able to recapture some of the fine moments, to be able to thank the infinite number of people, some who were with us from the beginning, some who joined us at some stage during the journey, whose rally round kindness, love and blessings has brought us to this day. We wish to thank each one of them with all our heart. To the best of my knowledge, the material included in this topic is having original sources which are appropriately acknowledge and referred. I would like to express my sincere gratitude to Miss. Suchida Lingayat student of ASPM College of Pharmacy, sangulwadi, vaibhavawadi and all teaching staff for their continuous guidance and support.

REFERENCES


