The herbal medicine occupy distinct position right from ancient period. The plant Calotropis procera is known by different names in different part of the world. It is a wild growing medicinal plant distributed throughout India. The various parts of the plant are practiced in various traditional systems of medicine around the world and popular among the various ethnic groups for the treatment of variety of ailments. Following the various traditional claims on use of _Calotropis procera_ in curing number of diseases, considerable efforts have been made by researchers to verify its utility through scientific pharmacological screenings. Pharmacological studies have revealed that aqueous and organic extracts of various parts of _Calotropis procera_ and its constituents possess a wide range of biological activities such as antidiabetic, analgesic, anti-inflammatory, antiarthritic, antioxidant, anthelmintic, antiscidial, wound healing, anticonvulsant, antimutou, antiarthritic, hepatoprotective and cytotoxic. The studies have also revealed the toxic effects of the plant in some experimental animal models on chronic use. This review presents a detailed survey of the literatures on traditional, pharmcognostical, phytochemical and experimentally evaluated medicinal uses of _Calotropis procera_.

**Keywords:** Calotropis procera, Medicinal plants, Ayurvedic medicine, Pharmacological studies, Toxic effects

### Table 1: Vernacular Names of _Calotropis Procera_

<table>
<thead>
<tr>
<th>Languages</th>
<th>Vernacular Names</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sanskrit</td>
<td>Shweta arka, Ravi, Arka</td>
</tr>
<tr>
<td>English</td>
<td>Madar tree</td>
</tr>
<tr>
<td>Hindi</td>
<td>Ak, Akavana, Madar</td>
</tr>
<tr>
<td>Marathi</td>
<td>Rui, Mandara</td>
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<tr>
<td>Gujarati</td>
<td>Akado</td>
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<tr>
<td>Punjabi</td>
<td>Ak</td>
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<tr>
<td>Kannada</td>
<td>Ekkadagida</td>
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<td>Telugu</td>
<td>Jilledu</td>
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<td>Tamil</td>
<td>Vellerukku</td>
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<td>Urdu</td>
<td>Madar, Aak</td>
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<td>Kashmiri</td>
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<td>Bengali</td>
<td>Akanda, Akone</td>
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<td>Assami</td>
<td>Akan, Akan</td>
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<tr>
<td>Malayalam</td>
<td>Eriku</td>
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</table>

**Medicinal Uses: In Traditional Medicine**

The plant has been widely used in the Ayurvedic, Unani, Arabic and Sudanean-Indian traditional system of medicine for the treatment of various ailments. It has been used as a purgative, anthelmintic, digestive, stomachic, emetic, expectorant, sedative, blood purifier, an antidote for snake poisoning and for the treatment of ulcers, tumors, leprosy, asthma, boils, dysentery, eczema, piles and diseases of liver, abdomen and spleen1.

**Ethnobotanical Uses**

Almost all the parts of _C. procera_ have been documented to possess medicinal virtues in ethnobotanical surveys conducted by researchers in India. The kol tribes of Banda district, Uttar Pradesh are using leaves for the cure of cold, cough and latex for toothache and scorpion bite1. The tribals of sagar district of Madhya Pradesh using latex of the plant for the treatment of dropsy, rheumatism, leprosy and taeniasis while roots for elephantiasis3. Taxo-ethnobotanical studies of rural areas in rajouri district of Jammu have reported that the

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*Email: drsudeshgupta@gmail.com

**ABSTRACT**

The herbal medicine occupy distinct position right from ancient period. The plant Calotropis procera is known by different names in different part of the world. It is a wild growing medicinal plant distributed throughout India. The various parts of the plant are practiced in various traditional systems of medicine around the world and popular among the various ethnic groups for the treatment of variety of ailments. Following the various traditional claims on use of _Calotropis procera_ in curing number of diseases, considerable efforts have been made by researchers to verify its utility through scientific pharmacological screenings. Pharmacological studies have revealed that aqueous and organic extracts of various parts of _Calotropis procera_ and its constituents possess a wide range of biological activities such as antidiabetic, analgesic, anti-inflammatory, antiarthritic, antioxidant, anthelmintic, antiscidial, wound healing, anticonvulsant, antimutou, antiarthritic, hepatoprotective and cytotoxic. The studies have also revealed the toxic effects of the plant in some experimental animal models on chronic use. This review presents a detailed survey of the literatures on traditional, pharmcognostical, phytochemical and experimentally evaluated medicinal uses of _Calotropis procera_.

**Keywords:** Calotropis procera, Medicinal plants, Ayurvedic medicine, Pharmacological studies, Toxic effects

**INTRODUCTION**

_Calotropis procera_ is a genus of about six species of shrubs or small trees, distributed in tropical and subtropical Africa and Asia. Among these three species found in India and two of them, _C.procera_ and _C.gigantia_ are of economic and medicinal importance. The generic name _Calotropis_ is taken from kalos (~beautiful) and _Tropis_ (~a keel), alluding to the good look of the keel of flower. _Calotropis procera_ of family Asclepiadaceae is a tropical plant growing wild in warm climate upto an altitude of about 1050 meters. The plant is distributed throughout india particularly abundant in Rajasthan. It also occurs in Pakistan, Africa, Mexico, Australia, Egypt, Central and South America and Caribbean island4. The Plant is a small shrub covered with cottony tomentum. The bark is soft, corky and light grey. The leaves are opposite, sessile, oblong-obovate, short pointed to blunt at the apex and are about 7 to 18cm long and 5 to 13cm broad, slightly leathery and have a fine coat of soft hair. The flowers are white to pink or spotted purple. The fruit are inflated, 8-12cm long, grey-green in colour and release flat, brown seeds with a tuft of white hair at one end. The roots are simple, whitish-grey in colour with wrinkles, curved woody appearance and exhibit marks of sap exudation on the surface. The root is bitter in taste and has no specific odour. The aerial parts of the plant contain milky sap called latex present in the lactiferous channels5. _Calotropis procera_ is known by various names like Dead sea apple, Sodom apple, Swallow wort, and Milkweed. In India, the plant is known by various vernacular names.

The various parts of the plant viz., flowers, stem, leaves, roots and the milky latex are practiced in various indigenous systems of medicine around the world and popular among the various ethnic groups in India for the treatment of variety of ailments. Following a large number of claims on the wide range of folk medicinal properties of _C.procera_, considerable efforts have been made by the researchers to justify its efficacy as a curative agent through pharmacological investigations. The objectives of present review is to highlight the various traditional, folkloric uses, pharmacognostical, phytochemical and pharmacological investigations carried out over years, to explain the multifaceted role of this medicinal plant.
native villagers are using latex for application on wounds and as a masticatory. In other surveys, latex has been described to possess abortifacients, antiseptic and laxative properties. The roots of the plant reported to be beneficial in cough, asthma, fever and swellings; while flowers for the treatment of cholera and stomach disorders.

In Ayurveda

The plant is attributed medicinal in number of classical texts of Ayurveda like Ashtang Hridays, Bhavprakash Nigantu, Dhanvantri Gritra, Raj Nigantu, Shaligram Nigantu, Sushruta Samhita, etc. It is reported to have tiktara, laghu guna, ushna virya and katu vipaka. It is mentioned as bitter tonic, laxative, anthelmintic, expectorant and to cure ulcers. The leaves are applied hot to the pain inside. The flowers are described as tonic, appetizer, stomachic, antialagogue, to cure piles and asthma. The roots of the plant are reputed to be useful and utilized in preparation of Dhanvantri Gritra, Chitrakadi taila, Prabhanjana Vimardana taila, Mahanarayan taila, Saindhavadi taila, Arka lavana, Abhaya lavana, Vajraka kshara, Ekangveera rasa, Bhrihat Kasturibhaira rasa, Vatavidhavamsana rasa, etc. All these are classical Ayurvedic preparations.

Non-Therapeutic Utilities

Latex obtained from the plant is used to a limited extent in the tanning industry for the purpose of deodorizing, removing hairs and imparting a yellow color to the hides. Stem of the plant yields fibers, which are used in rural parts of India for making fishing nets and lines, bowstrings and twine. The floss, being short stapled, by admixing with cotton used for stuffing mattresses and pillows.

Pharmacognostical Studies

Leaf: Transverse section through midrib shows an upper and lower single layered epidermis externally covered with thick, striated cuticle, few epidermal cells on both surfaces of leaf elongated to form uni-seriate, 2-3 celled trichomes, epidermal cells cubical and radially elongated, epidermis followed by 3-8 layered collenchyma on both lower and upper surfaces, parenchymatous cells thin walled, isodiametric to circular with intercellular spaces present in ground tissue, stele crescent shaped composed of bicolateral and open vascular bundle, xylem consists mostly of vessels and tracheids, a strip of cambium present between xylem and phloem tissue, laticifers also present in phloem and parenchymatous zone. Lamina shows mesophyll differentiated into a palisade and spongy tissue, upper and lower epidermis covered externally with a thick, striated cuticle, spongy parenchyma tissues almost radially elongated with intercellular spaces, central cells irregular in shape, laticiers and vascular bundles also present scattered in this region.

Pharmacological Activities

Antidiabetic Activity

Dry latex of C. procera was evaluated for its antioxidant and anti-hyperglycemic effects against alloxan-induced diabetes in rats. Daily oral administration of dry latex at 100 and 400mg/kg doses produced a dose dependent decrease in the blood glucose and increase in the hepatic glycogen content. Dry latex also prevented the loss of body weight in diabetic rats and brought down the daily water consumption to values comparable to normal rats. Dry latex also produced an increase in the hepatic levels of the endogenous antioxidants, namely superoxide dismutase (SOD), catalase and glutathione, while it brought down the levels of the thiobarbituric acid-reactive substances (TBARS) in alloxan-induced diabetic rats. The efficacy of dry latex as an antioxidant and as an anti-diabetic agent was found comparable to the standard anti diabetic drug, glibenclamide.

In one study the various parts of the plant, viz. roots, aerial parts and latex have been evaluated for analgesic activity.
The ethanol extract of aerial parts, chloroform extracts of roots and the aqueous solution of dried latex were tested in acetic acid induced writhing model and exhibited significant analgesic activity. The ethanolic extract of flowers of the plant found to possess a weak analgesic activity.

**Antipyretic Activity**

The ethanolic extract of the aerial parts, aqueous extract of flowers and aqueous solution of the dry latex of the dry latex of *C. procera* showed significant antipyretic activity in animal models that was comparable to aspirin.

**Anti Inflammatory Activity**

The crude dry latex of *C. procera* possesses a potent anti-inflammatory activity. The anti-inflammatory activity of petroleum ether, acetone, methanol and aqueous extracts of dry latex of *C. procera* was tested in the carrageenan induced rat paw oedema model. All the fractions exhibited rat paw edema model. All the fractions exhibited anti-inflammatory activity but inhibition of edema was found to be greatest with the acetone and aqueous extracts.

The anti-inflammatory property of the latex of *C. procera* was studied on carrageenan and formalin-induced rat paw oedema model. A single dose of the aqueous suspension of the dried latex was effective to a significant level against the acute inflammatory response.

A chloroform-soluble fraction from *C. procera* root showed significant dose-related anti-inflammatory activity in rats using the pharmacologic models of carrageenan-induced pedal oedema, cotton pellet granuloma and formaldehyde-induced arthritis.

**Hepatoprotective Activity**

The latex of *C. procera* was evaluated for its hepatoprotective effect against carbon tetrachloride(CCL4)-induced hepatotoxicity in rats. Subcutaneous injection of CCL4 administered twice a week, produced a marked elevation in the serum level of aspartate transaminase (AST), factor alpha(TNF-α). Histological analysis of the liver of these rats revealed marked necroinflammatory changes that were associated with increase in the levels of TBARS, PGE2 and catalase and decrease in the levels of glutathione (GSH), superoxide dismutase (SOD) and glutathione peroxidase (GPx). Daily oral administration of aqueous suspension of dried latex (DL) of *C. procera* at 5, 50 and 100mg/kg doses produced a dose-dependent reduction in the serum levels of liver enzymes and inflammatory mediators and attenuated the necro-inflammatory changes in the liver.

Hydro-ethanolic extract (70%) of *C. procera* flower was tested for its hepatoprotective effect against paracetamol-induced hepatitis in rats. Alteration in the levels of biochemical markers of hepatic damage like SGPT, SGOT, ALP, bilirubin, cholesterol, HDL and tissue GSH were tested in both treated and untreated groups. Paracetamol (2g/kg) has enhanced the SGPT, SGOT, ALP, bilirubin and cholesterol levels and reduced the serum levels of HDL and tissue level of GSH. Treatment with hydro-ethanolic extract of *C. procera* flower (200mg/kg and 400mg/kg) has brought back the altered levels of biochemical markers to the near normal levels in the dose dependent manner. In one study, evaluated hepatoprotective activity of chloroform extract of roots of *C. procera* against CCL4 induced liver injury and found to possess significant protective activity.

**Antihelmintic Activity**

The latex of *C. procera* has been shown to possess anthelmintic activity against Haemonchus contortus infection in Najdi sheep. Inappetence, dullness, erosive abomasitis, decreased haemoglobin concentration and increased eosinophils were the main features of haemonchosis in the sheep. In the sheep treated with single oral doses of 0.01 ml and 0.02 ml/kg body weight of *C. procera* latex, it significantly decreased the egg production and fewer adult Haemonchus worms were found in the abomasums. Although the appetite improved, the hemoglobin concentration and serum copper, iron, and zinc levels were still reduced after therapy with *Calotrops* latex. Both fresh and aqueous extract of dried latex were evaluated for their anthelmintic potential using adult earthworms as test worm. Both fresh and aqueous extract exhibited a dose-dependent inhibition of spontaneous motility and evoked responses to pin-prick. With higher doses (100% fresh latex) the effects were comparable with that of 3% piperazine. The study suggested that it might be effective against parasitic infections of both animals and humans caused by Ostertagia, Nematodirus, Dictyocaulis, Taenia, Ascaris and Fasciola. The anthelmintic activity in comparison with levamisole through in vitro and in vivo studies and found activity against nematodes.

**Spasmolytic Activity**

The aquas extract of *C. procera* was evaluated for its spasmolytic effect using in vitro trachea smooth muscle chain of guinea pigs. The extract(50, 100 & 200 μg/ml) showed a dose dependent relaxant activity probably exhibited through the direct relaxant action on the smooth muscles.

**Antimalarial Activity**

Following an ethnobotanical approach, screened the ethnolic extracts of *C. procera* leaves, stems roots flowers and flower buds, for their in vitro anti malarial activity against chloroquine sensitive and chloroquine resistant plasmodium falciparum strains. In further investigation in vitro haemolysis of human erythrocytes have been studied with above extracts. The putative anti-plasmodium activity of the extracts was correlated to their cytotoxicity as represented by the in vitro rate of haemolysis.

**Antidiarrhoeal Activity**

The dry latex of *C. procera* has been evaluated for antidiarrhoeal activity. Like atropine and phenylbutazone, single oral dose of dry latex 500mg/kg produced a significant decrease in frequency of defecation, severity of diarrhea and afforded protection from diarrhea in 80% rates treated with Castor oil. DL produced a decrease in intestinal transit (27-37%) as compared to both normal and Castor oil treated animals. Unlike atropine, dry latex significantly inhibited castor oil induced enteropooling. However, it did not alter the electrolyte concentration in the intestinal fluid as compared to castor oil treated rats.

**Wound Healing Activity**

Based on its traditional use, this plant was evaluated for its wound healing potential. For this purpose four full thickness excisional wounds of 8.0mm diameter were inflicted on the back of guinea pigs. Topical application of 20μl of 1.0% sterile solution of the latex of *C. procera* twice daily was followed for 7 days. The latex significantly augmented the healing process by markedly increasing collagen, DNA and protein synthesis and epithelisation leading to reduction in wound area thus the study provided a scientific rationale for the traditional use of this plant in the management of wounds.

**Antiasthmatic Activity**

Following the ethnobotanical approach, flowers of *C. procera* have been evaluated for its usefulness in the treatment of asthma. A clinical study on human beings showed the good recovery from the symptoms of asthma.
Toxicity Report

Although *C. procera* is associated with variety of medicinal virtues, but has been observed to be potentially injurious after prolonged or chronic use. In one study, the effect of flower extract of plant on testicular function of the Indian desert male gerbil meriones hurrianae. The extract was given orally for 30 days and caused wide spread testicular necrosis.12

CONCLUSION

In present scenario, traditional knowledge system in our country is fast eroding and there is an urgent needs to inventoried, record all ethno-botanical and cultural information among the diverse ethnic communities before the traditional cultures is completely lost. Therefore documentation of information on ethnomedicinal uses will help in conserving the knowledge. Many traditional plant based remedies are back in use and find increasing application as source of direct therapeutic agents, as raw materials based for the elaboration of more complex semi synthetic compounds, as models for new synthetic compounds and as taxonomic markers for the discovery of new compounds. A comprehensive database of the plants used for various purposes could be saved for the forthcoming generations. The eco-medico-botanical study on the plant *C. procera* has revealed the enormous diversity of its medicinal uses and popular use of the plant *C. procera* for a widrange of common ailments like fever, indigestion, cough, cold, eczema, asthma, elephantiasis, nausea, vomiting and diarrhea. The following activities such as antiinflammatory, antioxidant, analgesic, wound healing and cytotoxic, etc. are shown by the plants. In conclusion, the present manuscript emphasized the potential of the drug *Calotropis procera*.

REFERENCES