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CALOTROPIS PROCERA: AN ETHNOPHARMACOLOGICAL UPDATE

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ABSTRACT:

Calotropis procera (Ait.) R. Br, a wild growing plant of family *Asclepiadaceae*. The plant is one of the important traditional herbal medicines in every home of India. The traditional folk healers use the milky latex of aak for several ailments. The plant is anthelmintic, the ashes act as an expectorant. In African and Asian countries, the latex of *C. procera* is utilized as an arrow poison molluscide, a fungicide, an anti-syphilitic, an anti-inflammatory, a purgative and lepers. *C. procera* is considered for large scale cultivation as an alternative source for producing energy. *C. procera* containing hydrocarbons can be cultivated as fuel crops. Hence, with this huge ethnomedicinal uses of *C. procera,* we discuss the recent reported pharmacological actions with active chemical constituents present in *C. procera* (Ait.) R. Br.

Keywords: *Calotropis procera*, Ethnomedicinal, Latex, Anthelmintic.

INTRODUCTION

The traditional way of using herbal drugs has contributed a lot to human health especially in 21th century. Natural medicine improves the inner immune system of the human body, hence due to no side effect the herbal drug acts more effectively than the modern medicine. *Calotropis procera* (Ait.) is plant which is a soft-wooded, evergreen, perennial shrub. It has one or a few stems, few branches, and relatively few leaves, mostly concentrated near the growing tip. The bark is corky, furrowed, and light gray. A copious white sap flows whenever stems or leaves are cut. Giant milkweed has a very deep, stout taproot with few or no near-surface lateral roots. Giant milkweed roots were found to have few branches and reach depths of 1.7 to 3.0 m in Indian sandy desert soils[1]. The opposite leaves are oblong obovate to nearly orbicular, short-pointed to blunt at the apex and have very short petioles below a nearly clasping, heart-shaped base. The leaf blades are light to dark green with nearly white veins. They are 7 to 18 cm long and 5 to 13 cm broad, slightly leathery, and have a fine coat of soft hairs that rub off. The lower clusters are umbelliform cymes that grow at or near the ends of twigs. The flowers are shallowly campanulate with five sepals that are 4 to 5 mm long, fleshy and variable in color from white to pink, often spotted or tinged with purple. The fruits are inflated, obliquely ovoid follicles that split and invert when mature to release flat, brown seeds with a tuft of white hairs at one end[2,3,4]. It roots very deeply and rarely grows in soils that are shallow over unfractured rock. Soils of all textures and derived from most parent materials are tolerated, as well as soils with high sodium saturation. Beachfront salt spray is not detrimental. Competition with tall weeds, brush, and especially grass weakens existing plants, and being overtopped and shaded by trees soon eliminates them. The plant is occasionally grown as an ornamental in dry or coastal areas because it is handsome, of a convenient size, and is easy to propagate and manage. It is recommended as a host plant for butterflies[5]. In the past, the silky hairs were used to stuff pillows. *Calotropis procera* was tested as a host for sandalwood, *Santalum album* L., a partial root parasite. It resulted in greater growth of sandalwood than all other species tested[6]. Extracts, chopped leaves, and latex have shown great promise as nematicides, i*n vitro* and *invivo*[7,8]. If the leaves are chopped and mixed with other feed, consumption greatly increases with no ill effects[9,10].

Fig. 1: Image of *Calotropis procera (Ait.)*

CLASSIFICATION[11,12]

Kingdom	:	Plantae – Plants
Subkingdom	:	Tracheobionta – Vascular plants
Superdivision	:	Spermatophyta – Seed plants
Division	:	Magnoliophyta – Flowering plants
Class	:	Magnoliopsida – Dicotyledons
Subclass	:	Asteridae
Order	:	Gentianales
Family	:	Asclepiadaceae – Milkweed family
Genus	:	Calotropis R. Br. – calotropis
Species	:	Calotropis procera (Aiton) W.T. Aiton – roostertree

Scientific and Vernacular name[13,14,15]:

Giant milkweed is also known as sodom apple, calotrope, French cotton, small crown flower (English), algodón de seda, bomba (Spanish), cotton-france, arbre de soie, and bois canon (French) Calotropis procera L. (Asclepiadaceae). Vernacular name: Vellerukku. (Sanskrit) Arka, Alaka, Ravi (Hindi) Aaka, Aanka, Ak (German) Wahre Mudarpflanzer, Gomeiner (Italian) Calotropo (Spanish) Algodon extranjero, Cazuela (Turkish) Ipekag.

Distribution and Occurrence[16-18]:

Calotorpis procera in India holds a pride of place largely because of its other uses

and economic values. The genus Calotropis R. Br. (Asclepiadaceous) is distributed in tropical and subtropical regions of Asia and Africa. It is represented in India by two species viz. C. procera and C. gigantean. *C. procera* is native to West Africa as far south as Angola, North and East Africa, Madagascar, the Arabian Peninsula, southern Asia, and Indochina to Malaysia. The species is now naturalized in Australia, many Pacific islands, Mexico, Central and South America, and the Caribbean islands. Giant milkweed favors open habitat with little competition. This condition is most completely met in overgrazed pastures and rangeland. Other common habitats are beachfront dunes, roadsides, and disturbed urban lots. The species grows in dry habitat (150 to 1000 mm precipitation) and sometimes in excessively drained soils in areas with as much as 2000 mm of annual precipitation. ***Calotropis procera*** may be found in areas up to 1,000 m in elevation in India.

Traditional Uses[19-31]: In Indian or in Sub-continent the use of herbal plants and medicinal plants has been the golden remark of the 21th century. *Calotropis procera* is one of the important numbers of traditional herbal medicine in every home of India. The medicinal value of *Calotropis procera* has been described in older pharmacopeia. It strongly recommended in leprosy, hepatic and splenic enlargements, dropsy and worms. The latex is applied to painful joints and swelling, fresh leaves are also use for the same purpose. Oil which the leaves have been boiled is applied to paralyzed part. The milky juice is used in India as purgative, while flowers are considered as digestive, stomachic, tonic and useful in cough, asthma catarrh and loss of appetite. The root bark is said to promote secretion and to be useful in treating skin disease, enlargement of abdominal viscera, intestinal worms, ascites and anasarca. Traditionally the leaves of aak are warmed and tied around any body organ in pain. It is practically useful in backache and in joint pains. Warm leaves also relieve from stomach ache if tied around. Inhalation of burnt leaf cures headache. The traditional folk healers use the milky latex of aak for several ailments. Leaf latex if applied on fresh cut, stops bleeding immediately. Recent investigations have found that the alkaloids calotropin, calotaxein and uskerin are stimulant to the heart. Flowers and roots are used in Ayurvedic medicine. The plant is anthelmintic, the ashes act as an expectorant. The leaves are applied hot to the abdomen to cure the pain inside. The flower is tonic, antisialagogue, used as appetizer and against stomach ache, and cures piles and asthma. Flowers are believed to have detergent properties so

they are given in cholera. The fresh roots are used as a toothbrush and are considered by pathans to cure toothache. Alarka is an alternative tonic and diaphoretic, in large dose emetic. Root bark is useful for treating chronic cases of dyspepsia, flatulence, constipation, loss of appetite, indigestion and mucus in stools. Leaves are used against guinea worms. Flowers are useful in asthma. Seed oil is geriatric and tonic. Green copra is given in asthma. Plant is used in spleen complaints, rheumatism, epilepsy, hemiplegia, sores, and smallpox and protracted labor. The root skin, latex, flowers, leaves and the ksara of arka are used for medicinal purpose. Arka is useful both, internally as well as externally. The poultice of its leaves effectively reduces the pain and swelling in rheumatic joints and filariasis. The medicated oil is beneficial in otitis and deafness. The topical sprinkle of dried leaves powder hastens the wound healing. In glandular swellings the topical application of latex reduces the inflammation. In skin diseases, associated with depigmentation, the latex combined with mustard oil, works well. The fomentation with its leaves, slightly warmed with thin coat of castor oil, is beneficial to relieve the abdominal pain. The local application of latex is recommended in hair fall and baldness. It also, is useful in piles. The latex also mitigates the dental aches.

Internally, arka is very useful many diseases, especially in ascites. The latex as a strong purgative and accumulations breaking imparts excellent results in ascites of kapha type and hepatosplenomegaly with ascites. To alleviate the oedema in such conditions, of kapha origin, the decoction of its roots combined with triphala and honey, is salutary. In asthma and cough, the flowers and the root skin of arka are commonly used. As a blood purifier, it is benevolent is filariasis and syphilis, the red flowers alleviate raktapitta. In chronic dermatoses, the root skin is recommended with honey. The large doses of its latex and leaf juice produces toxic symptoms like burning in throat, irriation of the stomach, nausea, vomiting, diarrhoea, tremors, vertigo and convulsions. In these conditions, withdraw the use of arka or its preparations and advise the milk and ghee in diet. The schematic percentage use of parts of *C. procera* is explained in figure no. 2 and table.

Chemical Constituents[32-38]: The ***Calotropis procera*** plant has many medicinal properties due to the presence of numerous secondary metabolites. This compound includes various chemicals which are useful for various activities. After chemical screening of latex of

Calotropis procera the latex revealed that the plants contain cardenoids such as calotropin, calotoxin, uscharin, usechardin, glycoside calotropaginin, choline, o-pyrocatechuric acid, Benzoyllineolone, benzoylisoloneolane, uzariganin and syriogenin. In the root of the ***Calotropis procera*** pentacyclic triterpenes, alkaloid, cardinolides phytosterols and triterpenoid saponins have been isolated from roots. The leaves, flower and roots contained high amount of ash and protein (10.9-11.7%) with varying quantities of alkaloids, leaves contained calotropin and calotropegenin. The root bark was found to contain long chain of fatty acid, sterol, and resin. A polysaccharide was isolated from aq. Extract of leaves of this plant. It also indicates the presence of D-glucose, D-abrabinose, D-glucosamine and L-rhamnose.

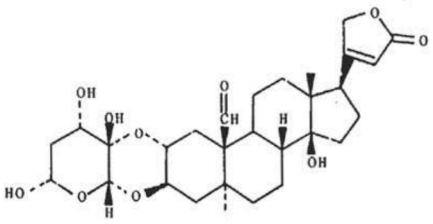

Fig. 2: Calotropin

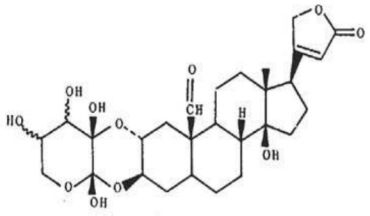

Fig. 3: Calotoxin

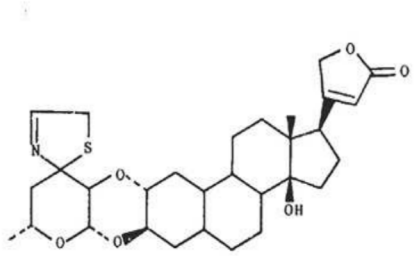

Fig. 4: Uscharin

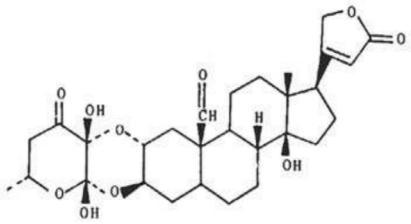

Fig. 5: Usechardin

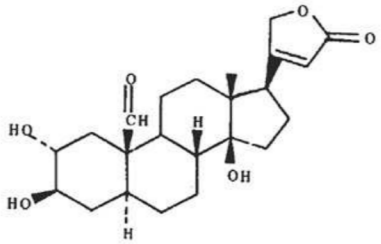

Fig. 6: Glycoside calotropaginin

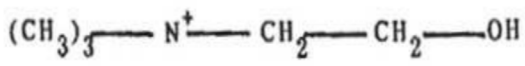

Fig. 7: Choline

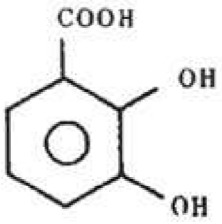

Fig. 8: o-pyrocatechuric acid

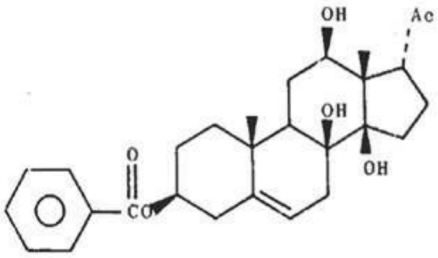

Fig. 9: Benzoyllineolone

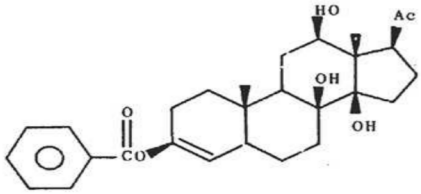

Fig. 10: Benzoylisoloneolane

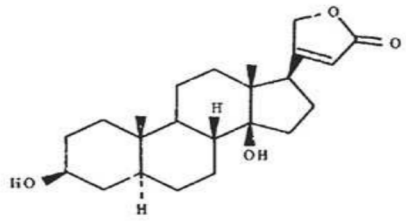

Fig. 11: Uzariganin

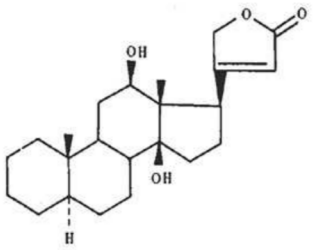

Fig. 12: Syriogenin

Pharmacological Activity

1. **Protective activity** (Kumar V.L et al., 2010) studied the protective effect of methanolic extract of C.P. latex on experimentally induced gastric ulcers in rats. The methanolic extract was found to inhibit mucosal damage in both ethanol (85-95%) and aspirin (70-80%) model, with significant reduction in gastric hemorrhage and tissue integrity was maintained. Further the level of oxidative stress markers like glutathione, thiobarbituric acid reactive substance and superoxide dismutase were found to be regulated[39].
2. **Anthelmintic activity** (Zafar Iqbal et al., 2005) has compared the CP flower with levamisole through in-vitro and in vivo studies. For invitro studies it was found that anthelmintic effect ($p<0.05$) of crude aqueous extracts and crude methanolic extracts of CP flower on live haemonchus contortus as evident from their mortality or temporary paralysis and in in-vivo studies CP flower were administered as a crude powder, crude aqueous extract and crude methanolic extracts to sheep. The egg count percent reduction (ECR) when infected with GI nematodes was found to be 88.4% and 77.8% in sheep treated with mixed CAE[40].
3. **Anti-inflammatory activity** (Kumar V.L. et al., 2002) studied the anti-inflammatory property of latex of CP on carragenin and formalin induced rat paw odema model. A single dose of aqueous suspension of the dried latex was effective to significant level against the acute inflammatory response[41].

4. **Anti-diarrhoeal activity** (Kumar V.L. et al., 2001) evaluated the anti-diarrhoeal activity of dry latex of CP. The author found significant decrease in frequency of defecation (dose DL 500mg/kg) severity of diarrhoea and afforded protection from diarrhoea in 80% rats treated with castor oil induced intestinal accumulation and electrolyte concentration in the intestinal fluid. It was observed that dry latex produce a decrease in intestinal transit (27-31%) as compared to both normal and castor oil treated animals. It was found that like atropine, dry latex significantly inhibited castor oil induced enteropooling[42].
5. **Antinociceptive activity** (Silvania M.M. Vasconcelos et al., 2005) evaluated the antinociceptive effect of proteins of CP latex using three different experimental models of nociception in mice. The latex protein fraction administered in intraperitoneally in male mice at the dose o 12.5, 25 and 50 mg/kg which showed antinociceptive effect. Author observed that at dose of 25 (39.8%, 42%) and 50 (66.6%, 99.3%) reduce the nociception produce by formalin in the 1st and 2nd phase, respectively. In hot plate test, an increase of the reaction time was observed only at 60 min after the treatment with latex at the dose of 25 (79.57%) and 50 (76.9%) mg/kg. Author also observed that the antinociceptive activity is independent of opioid system[43].
6. **Antioxidant** and **Antidiabetic activity** (Kumar V.L. et al., 2005) author has evaluated the antioxidant activity of dried latex of CP and antidiabetic effect against alloxan-induced diabetes rats. By administrating the oral dose of dry latex at 100 and 400 mg/kg the decrease in blood glucose and increase in the hepatic glycogen content was observed[44].
7. **Myocardial infarction** (K.K. Mueen Ahmed et al., 2004) latex obtained from CP was evaluated for protection against isoproterenol (20 mg/100g) induced myocardial infarction in albino rats. The pretreatment with an ethanolic latex extract of CP at a dose of 300 mg/kg body weight administered orally three times a day for 30 days, reduced significantly ($p<0.01$) the elevated markers enzyme levels in serum and heart homogenates in isoproterenol induced myocardial infarction[45].
8. **Antifertility activity** (Kamath J. V. et al., 2002) has studied the antifertility activity of ethanolic extract of roots of CP. A strong antiimplantation (inhibition 100%) and uterotropic

activity was observed at the dose level of 250 mg/kg (1/4 of LD_{50}). No antiestrogenic activity could be detected[46].

9. **Schizontocidal activity** (P. Sharma and J.D. Sharma 1999) author has attempted to see the effect of crude fractions of its flower, bud and root again a chloroquine sensitive strain, MRC 20 and a chloroquine resistant strain, MRC 76 of Plasmodium falciparum using the Desjardins method and the effectiveness of its fractions compare better with the CQ sensitive strain than the CQ resistant strain in vitro[47].
10. **Analgesic activity** (Kumar V.L. et al., 2000) has evaluated the analgesic activity of dry latex of CP. It was observed that a single dose of dried latex ranging from 165 to 830 mg/kg produced a significant dose dependent analgesic effect against acetic acid induced writhings. Another thing was noticed that the dried latex (830 mg/kg) produced marginal analgesia in tail-flick model which was comparable to aspirin. The 830 mg/kg dose of dried latex did not produce toxic effects in mice and the LD_{50} was found to be 3g/kg[48].
11. **Anticancer** and **Cytotoxic properties** (Choedon Tenzin et al., 2006) evaluated the anticancer and cytotoxic properties of the latex of CP in transgenic mouse model of hepatocellular carcinoma it was found that the mice which was treated with the DL of CP showed a complete protection against hepatocarcinogenesis, no adverse effect was observed in these animals. The serum vascular endothelial growth factor (SVEG) level was significantly lowered in treated mice as compared to control animal cell culture studied revealed that the methanolic extract of dried latex as well as its fraction 8 induced extensive cell death in both Huh-7 and COS-1 cells while AML12 cells were spared. This was accompanied by extensive fragmentation of DNA in Huh-7 and COS-1 cells. No change in the levels of canonical markers of apoptosis such as Bcl2 and caspase 3 was observed[49].
12. **Antioxidant and antibacterial activity** (Yesmin M. N. et al., 2008) has evaluated the antioxidant and antibacterial potential of methanol and aqueous extract of leaves of CP. The antioxidant potential of the methanolic extract was determined on the basis of their scavenging activity of the stable 1,1-diphenyl-2-picryl hydrazyl (DPPH) free radical. IC of 50 the methanol extract of *Calotropis procera* Linn. was 110.25 µg/ml which indicated the

strong antioxidant activity of the plant. However the aqueous extract showed mild antioxidant activity. For antibacterial activities test, the extract was subjected to its effectiveness against both Gram-positive and Gram-negative bacteria in agar diffusion method. The zones of inhibition produced by the crude methanol and aqueous extract against few sensitive strains were measured and compared with those of standard antibiotic Gentamycin. It is evident that both extracts are active against the bacteria at low concentrations. The obtained results provide a support for the use of this plant in traditional medicine and suggest its further advance investigation[50,51].

Table 1: Percentage of ethno medicinal uses of different plant parts of *C. procera* against total number of uses[52]

S. No	Parts used	Number of uses	Percentage of uses
1	whole plant	4	5.19
2	root	10	12.98
3	root bark	6	7.79
4	stem	2	2.59
5	stem latex	2	2.59
6	leaf	19	24.67
7	leaf latex	3	3.89
8	latex	22	28.57
9	flower	7	9.09
10	stigma	1	1.29
11	seed	1	1.29

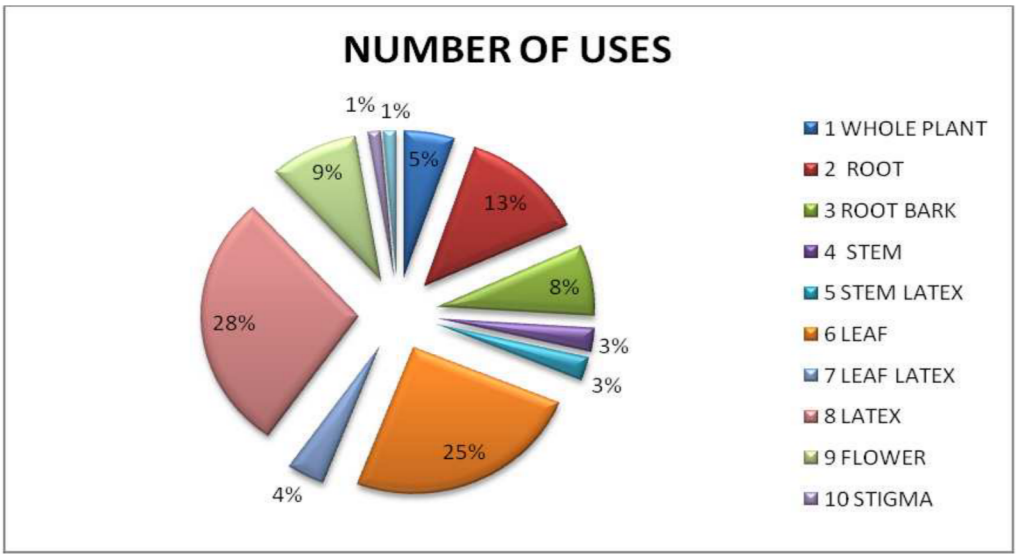

Fig. 13: Percentage of ethno medicinal uses of different plant parts of *C. procera* against total number of uses

CONCLUSION

In the 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 ethno-medicinal uses will help in conserving the knowledge. A comprehensive database of the plants used for various purposes could be saved for the forthcoming generations. Medicinal plants have been used since prehistoric period for the cure of various diseases. Since these are in common use by the local people and are of great importance that's why a lot of people are engaged in the trade of important medicinal herbs throughout the world. Especially, people living in villages have been using indigenous plants as medicines since ages because this knowledge transfers from generation to generation and is based on lifelong experiences. Besides, the villages are far away from cities and mostly lack proper health facilities. This ethno-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 wide range of common ailments like fever, rheumatism, indigestion, cough, cold, eczema, asthma, elephantiasis, nausea, vomiting and diarrhoea. The following activities such as Antioxidant, antibacterial activity, Anticancer, Cytotoxic properties, Analgesic activity, Schizontocidal activity, Antifertility activity, etc. are shown by the plants. Moreover, it can be initiative for further phytochemical and pharmacological investigations about the medicinal use of the plant, which may be a step ahead towards the new drug development.

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