Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Vol 5 [7] June 2016: 74-81

Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD
Global Impact Factor 0.533
Universal Impact Factor 0.9804

REVIEW ARTICLE **OPEN ACCESS**

Calotropis procera (Madar): A Medicinal Plant of Various Therapeutic Uses-A Review

Bhumika Yogi*, Sujeet Kumar Gupta and Ashutosh Mishra
*Department of Pharmaceutical Chemistry, Hygia Institute of Pharmaceutical Education and Research, Lucknow
Department of Pharmaceutical Chemistry, Acharya Narendra Deo College of Pharmacy, Babhnan, Gonda
Corresponding footnote: * Email: bhumi.is.yogi@gmail.com

ABSTRACT
Calotropis procera R. Br. (Asclepiadaceae) has been known to the traditional systems of medicine and plant known as Madar in Unani medicinal system. Widely it is used medicinally, to treat boils, infected wounds and other skin problems in people. Calotropis procera is regarded as useful medicinal plant and used in folk medicine. This plant is popularly known because it produces large quantity of latex. Medicinal plants have no doubt remained the major sources of traditional medicine worldwide. A scrutiny of literature revealed some notable pharmacological activities of the plant such as Analgesic, hepatoprotective, anti-diarrhoeal, antidiabetic, antimalarial, antinociceptive, anti-inflammatory, anthelmintic, anticonvulsant, antimicrobial, anticancer, antifertility and antioxidant activity. The present review is an attempt to highlight the various ethanobotenical and traditional uses as well as phytochemical and pharmacological reports on Calotropis procera.
Key words: *Calotropis procera, Ethanobotenical uses, Pharmacognosy, Pharmacological activities*

Received 12.02.2016 Revised 24.04.2016 Accepted 26.05. 2016

INTRODUCTION

It is mentioned by the earliest Hindu writers and the primeval name of the plant which occurs in the vedic literature was Arka alluding to the form of leaves, which was used in the sacrifical cremation. Thereare two common species of Calotropis, viz. *Calotropis gigantea* (Linn.) and *Calotropis procera* (Ait.) described by the Sanskrit writers [1]**.** Giant milkweed is also known as Sodom apple. Vernacular names of *Calotropis* are Madar (Hindi); crown flower (English); Akanda (Bengali); Adityapuspiker (Sanskrit); Vellerukku (Tamil) and Ak (Punjabi) [2]**.** Ak is used in many ayurvedic formulations like Arkelavana etc. Especially the root bark are used to treat a variety of illness including leprosy, fever, menorrhagia, malaria and snake bite [3]**.** The taxonomy of the plant is described in Table 1 [4].

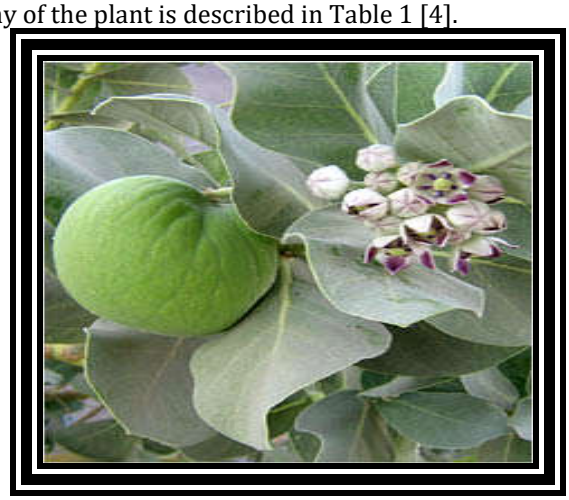


Fig 1. Twig of *Calotropis procera* plant

Table 1: Classification of *Calotropis procera*-

Kingdom -	Plantae
Division -	Magnoliophyta
Class -	Magnoliopsida
Subclass -	Asteridae
Order -	Gentianales
Family -	Asclipiadaceae
Subfamily -	Caesalpinioideae
Genus -	*Calotropis*
Species -	*procera*

ETHANOBOTANY OF PLANT

A small erect and compact shrub covered with cotony tomentum, up to 5.4 m in height, found growing wild throughout India in comparatively drier and warmer areas, up to an altitude 1050 m. *Calotropis procera* has been observed to grow mainly on coarse, sandy and alkaline soils. They are good soils binder and recommended for deserts. The life span of *Calotropis* is 12 years. It will be seen that root-bark from older plants has a higher percentage of acrid and bitter resinous matter than that from younger plants. In the supplement to the pharmacopoeia of India, he reports that he found that the older the plant, the more active is the bark in its effects [5].

MORPHOLOGICAL CHARACTERISTICS OF PLANT

The morphological studies revealed the plant is erect, tall, large, much branched and perennial with milky latex throughout. *Calotropis procera* have large bushy shrub, leaves decussate, inflorescence extra axillary umbellate panicale, corolla purple, lobes erect. The leaves are sub- sessile, 6-15 cm by 4.5-8 cm, broadly ovate, ovate-oblong, elliptic or obovate acute, pubescent; when young and glabrous on both sides when mature [6].

MICROSCOPICAL CHARACTERISTICS OF PLANT

Transverse section through midrib shows an upper and lower single layered epidermis externally covered thick, striated cuticle, few epidermis cells on both lower and upper surfaces, parenchymatous cells thin-walled, isodiametric to circular with intracellular spaces present in ground tissue, bicollateral and open vascular bundle, xylem consists mostly of vessels and tracheids, a strip of cambium present between xylem and phloem tissues. Palisade and spongy parenchymatous tissues are present [7].

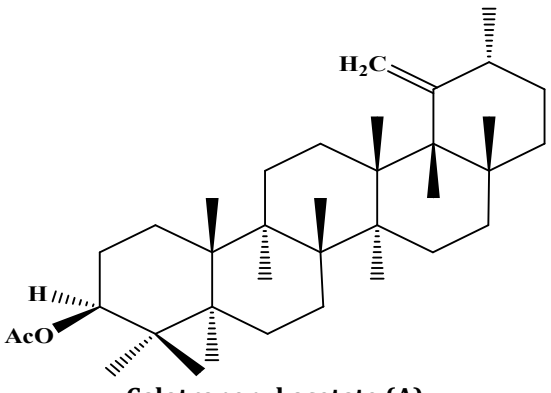
PURITY TESTS

Purity test of *Calotropis* procera depicts the following characteristics: 1) Foreign matter should not more than 2 percent, 2) Total ash content should not more than 21 percent, 3) Acid- insoluble ash should not more than 5 percent, 4) water-soluble extractives not less than 24 percent, 5) Alcohol-soluble extractive not less than 5 percent [8].

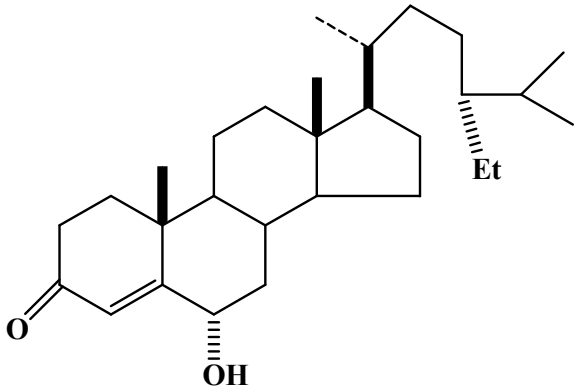
PHYTOCHEMISTRY

Phytochemically the plant has been investigated for cardenolides from the latex and leaves [9], triterpenoids [10, 11], anthocyanins from flowers [12] and hydrocarbons [13].

A systematic study on fresh and undried flowers has resulted in the isolation of pentacyclic triterpene that calotropenyl acetate (urs-19(29)-en-3β-yl acetate) **(A)**, Procesterol **(B)** (steroidal hydroxyl ketone) [14]. The chemical and spectral studies identified as C-6, C-24 diepimer of stigmast-4en-6β-ol-3-one [15]. *Calotropis procera* contain proceragenin an antibacterial cardenolide [16].



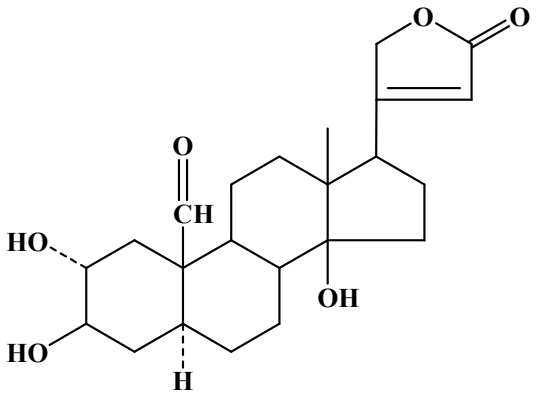
Calotropenyl acetate (A)



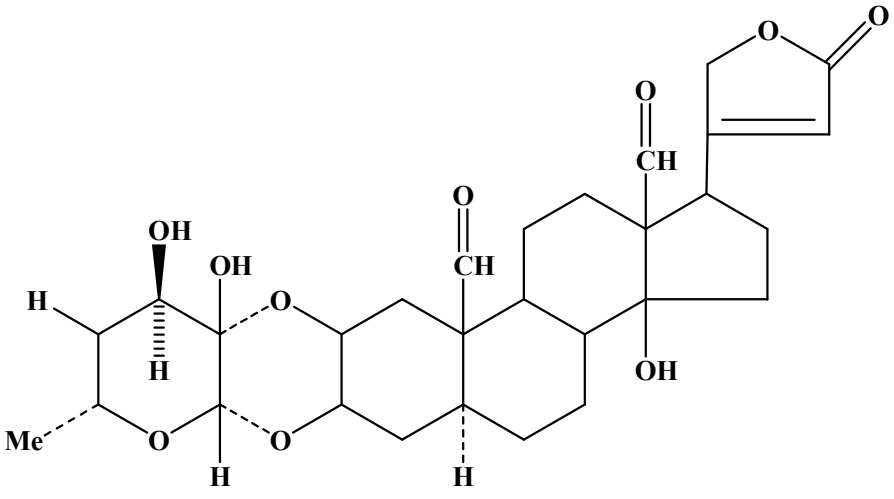
Procesterol (B)

Leaves of *Calotropis procera*

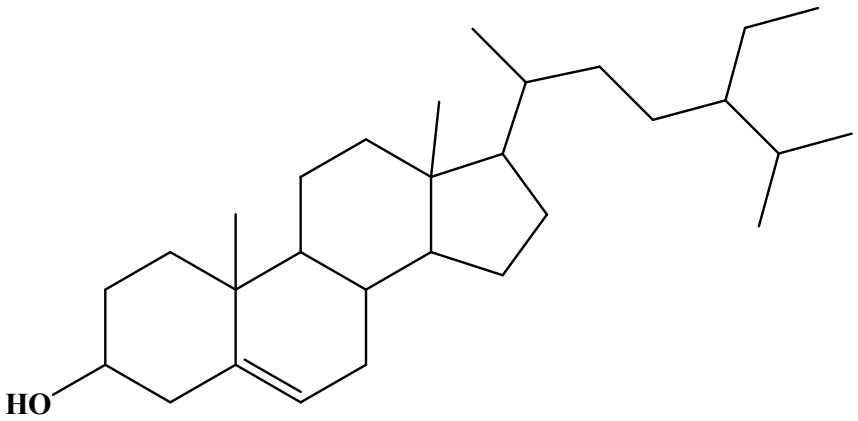
Calotropis procera leaves contained principally calotropagenin **(C),** calactin **(D)**, calotoxin, calotropin, taraxasteryl acetate, *β*-sitosterol **(E),** *α*-amyrins **(F)**, β amyrins **(G)**. Leaves also contain organic carbonate and stigmasterol (**H**) [17].



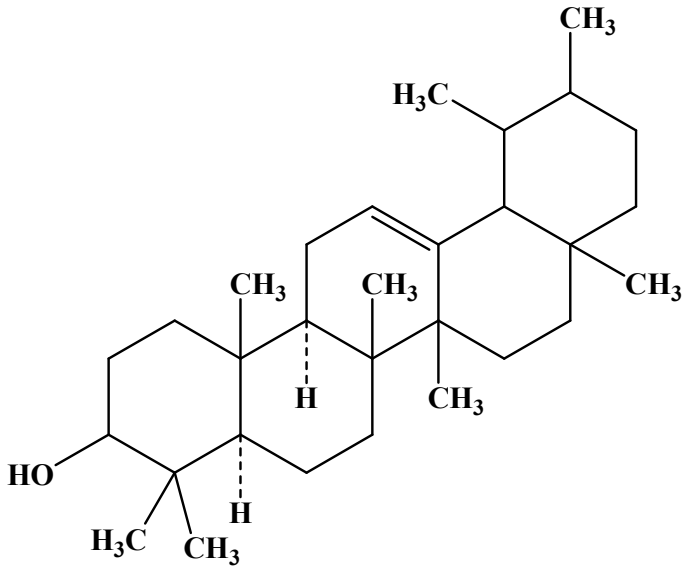
Calatropogenin (C)



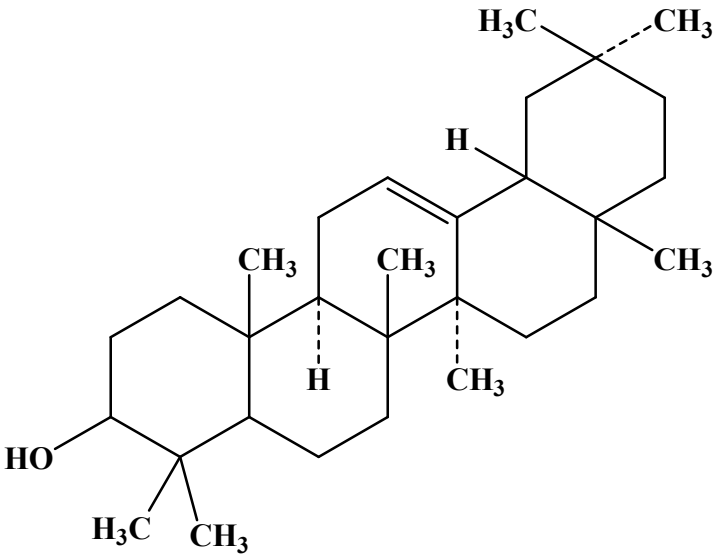
Calactine (D)



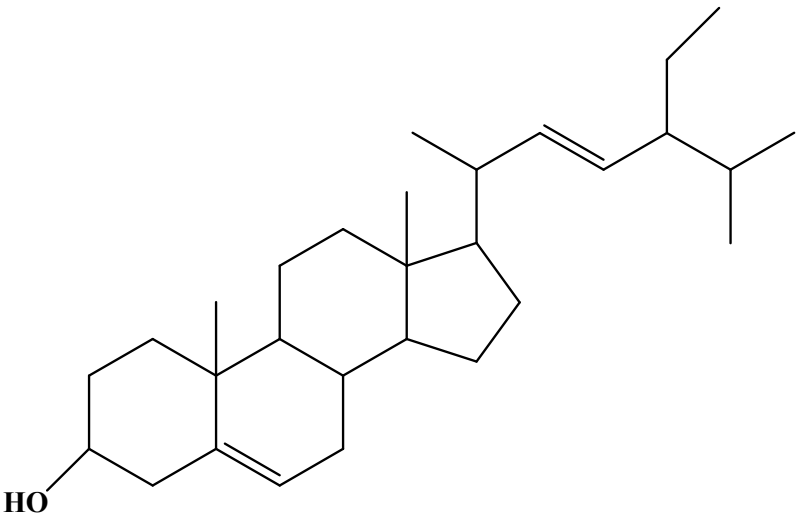
***β*-sitosterol (E)**



***α*-Amyrin (F)**



***β*-Amyrin (G)**



Stigmasterol (H)

The latex of *C. procera* contains about 88-93% water and water soluble. The chemical screening of its latex revealed that this plant contain cardinolides such as calotropin, calotoxin, uscharin, uscharidin, voruscharin [9].

The root of *C. procera* contains procerursenyl acetate and proceranol which were isolated by Ali et al., 2008**.** Root also contain n-Dotriacont-6-ene, glyceryl mono-oleolyl-2-phosphate, methyl myrisate, methyl behenate, glceryl-1, 2- dieapriate-3-phosphate [18].

TRADITIONAL USES

Whole plant was used to treat common diseases such as fever, rheumatism, indigestion, cold, eczema, diarrohea, for the treatment of boils and for the treatment of jaundice. The root was used for the treatment of eczema, leprosy, elephantiasis, asthma, cough, rheumatism and diarrhoea. In case of diarrhoea it changed the faecal matter into a semisolid mass within the first day of treatment. The stem was used for the treatment of skin diseases, intestinal worms, leprosy and cure leucoderma [19, 20].

PHARMACOLOGICAL ACTIVITIES OF *Calotropis procera* PLANT

1) Analgesic activity

Analgesic activity of dry latex (DL) of *Calotropis procera* was evaluated by Kumar et al (2000). A single oral dose of DL ranging from 165 to 830 mg/kg produced a significant dose dependent analgesic effect against acetic acid induced writhing. The effect of DL (830 mg/ml) produced marginal analgesic effect of DL was delayed by 1 h by naloxone at dose of 0.5mg/kg, i.p., which completely blocked the analgesic effect of morphine (10 mg/kg, i.p.). However, the effect of aspirin was not blocked by naloxone. The 830 mg/kg oral dose of DL did not produced toxic effects in mice and the LD_{50} was found to 3 g/ kg [21].

2) Hepatoprotective activity

Hydro-ethanolic extract (70%) of flowers was prepared and tested for its hepatoprotective effect against paracetamol-induced hepatitis in rats by Setty et al (2007). Alteration in the levels of biochemical markers of hepatic damage like SGPT, SGOT, ALP, bilirubin, cholesterol, HDL, tissue GSH were tested in both treated and untreated groups. Paracetamol (2.0 g/kg) has enhanced the SGPT, SGOT, ALP, bilirubin and cholesterol levels and reduced the serum level of GSH. Treatment with hydro-ethanolic extract of *Calotropis procera* flowers (200 mg/kg and 400 mg/kg) has brought back the altered levels of biochemical markers to the near normal levels in the dose dependent manner [22].

3) Anti-diarrhoeal activity

The dry latex (DL) of *Calotropis procera* (Asclepiadaceae), a potent anti-inflammatory agent has been evaluated for anti-diarrhoeal activity by Kumar et al (2001). Like atropine and phenyl butazone, a single dose of DL (500 mg/kg) produced a significant decrease in frequency of defecation, severity of diarrhea and afforded protection from diarrhea in 80% rats treated with castor oil induced intestinal fluid accumulation and electrolyte concentration in intestinal fluid. DL produced a decrease in intestinal transit (27-37%) as compared to both normal and castor oil treated animals. Unlike atropine, DL significantly inhibited castor oil induced enteropooling. [23]

4) Antidiabetic activity

In the present study, dry latex (DL) of *Calotropis procera* possessing potent anti-inflammatory activity was evaluated for its antioxidant and anti hyperglycemic effects against alloxen induced diabetes in rats by Kumar et al (2005). Daily oral administration of DL at 100 and 400mg/kg doses produced a dose-

dependent decrease in the blood glucose and increase in hepatic glycogen content. The efficacy of DL as an antioxidant and as anti-diabetic agents was comparable to the standard anti-diabetic drug, glibenclamide [24].

5) Antimalarial activity

From an ethanobotanical approach, the ethanolic extracts of *Calotropis procera* leaves, stems, roots, flowers and buds have been screened *in vitro* for anti malarial activity against chloroquine sensitive and chloroquine resistant *Plasmodium falciparum* strains [25].

6) Antinociceptive activity

This work evaluated the antinociceptive effect of proteins from the *Calotropis procera* (Asclepiadaceae) latex using three different experimental models of nociception in mice by Vasconcelos et al (2005). The latex protein fraction administered intraperitoneally in male mice at the doses of 12.5, 25 and 50 mg/kg showed the antinociceptive effect in dose dependent manner compared to the respective controls in all assays [26].

7) Anti-inflammatory activity

The anti-inflammatory property of the *Calotropis procera* was studied on carrageenin and formalin-induced rat paw edema model by Kumar et al (1994). A single dose of the aqueous suspension of the dried latex was effective to a significant level against the acute inflammatory response [27].

8) Anthelmintic activity

The anthelmintic activity of *Calotropis procera* flowers in comparison with levamisole was evaluated through *in vitro* and *in vivo* studies by Iqbal et al (2005). *In vitro* studies revealed anthelmintic effects ($P<0.05$) of crude aqueous and crude methanolic extracts of *Calotropis procera* flowers on live *Haemonchus contortus* as evident from their mortality or temporary paralysis. For *in vivo* studies, *Calotropis procera* flowers were administered as crude powder to sheep naturally infected with mixed species of gatrointrointestinal nematodes [28]**.**

The ethanolic extract of *Calotropis procera* (Ait.) R. Br. leaves were separated into n-butanol and water fractions. The n-butanol fraction was subjected to column chromatography. Ethanolic extract, n-butanol, and water fractions as well as n-hexane, chloroform, chloroform: methanol (9:1); chromatographic elutes of n-butanol fraction were evaluated for in-vitro anthelmintic activity using Indian earthworm Pheretima posthuma as a experimental models. The results revealed that ethanolic extract, water fraction, n-hexane, and chloroform elutes showed better activity as compared to n-butanol fraction and chloroform: methanol (9:1) elute of *Calotropis procera* (Ait.) R. Br. Leaves [29].

9) Anticonvulsant activity

Alcoholic extract of the roots of *Calotropis procera* was evaluated for various pharmacological parameters like acute toxicity, anticonvulsant, analgesic, anti-inflammatory and hypnotic activities by Kamath et al (2003). The extract at the dose level of 125 mg/kg and 250 mg/kg potentiated the hypnotic effect of pentobarbitone sodium and was found to posses significant analgesic and anti-inflammatory activities. However the extract failed to exhibit anticonvulsant activity both in leptazole and electroshock induced convulsion in rats [30].

10) Antimicrobial activity

The antimicrobial effect of ethanol, aqueous and chloroform extracts of leaf and latex of *Calotropis procera* on six bacteria, three fungi, *one yeast Candida albicans* were determined using agar well diffusion and paper disk methods (kareem et al. 2008) . The results revealed that ethanol was the best extractive solvent for antimicrobial properties of leaf and latex of *C. procera* followed in order by Chloroform and aqueous ($P<0.05$). The ethanolic extracts of *C. procera* latex gave the widest zone of inhibition (14.1mm) against E-coli using agar well diffusion while 9.0 mm was recorded for the same organism in the disc plate method.The growth of six bacterial isolates were inhibited by the three extracts except *P.aeruginosa* and *S.pyogenes* that were not inhibited by the aqueous extracts of both leaf and latex of *C.procera*. Similarly, the growth of four test fungi were inhibited by ethanol and chloroform extracts while the aqueous extract was the least effective on the test fungi. The best antifungal activity was recorded in ethanol extract of *C. procera* latex against *Candida albicans* [31].

11) Anticancer activity

An attempt was made to evaluate free radical scavenging activity, cytotoxic activity and polyphenolic content of methanolic extract of *Calotropis procera* flowers. Free radical scavenging activity was estimated using *in vitro* models like 1,1,-diphenyl-2- picryl hydrazyl (DPPH), hydroxyl radical, hydrogen peroxide radical, reducing power and ferric thiocyanate method. Cytotoxicity was analysed following MTT assay using Hep2 and Vero cell lines and polyphenols were estimated using standard methods. The methanol extract of *C. procera* at 500 µg/ml showed better scavenging activity in ferric thiocyanade method (83.63 %) with the lowest IC_{50} of 100 µg/ml followed by hydrogen peroxide, hydroxyl radical

scavenging and least activity was found to be present in DPPH assay (50.82 %). The extract had 100 % cytotoxicity on Hep2 cell lines [32].

12) Antifertility activity

The effect of ethanolic extract of the roots of *calotropis procera* has been studied in albino rats To explore its antifertility and hormonal activities. A strong antiimplantation (inhibition 100%) and uterotropic activity was observed at the dosenlevel of 250 mg/kg (1/4 of LD_{50}). No antiestrogenic activity could be detected [33].

13) Antioxidant activity

The different fractions of methanolic extract of leaf of *Calotropis procera* was tested for antioxidant activity using 1,1-Diphenyl-2-picryl hydrazyl radicals by Yogi et al (2011). The extracts of *Calotropis procera* exhibited that fraction F3 of chromatographic elutes of methanolic extract having IC_{50} 82 ± 5.23 mg/ml showed potent antioxidant activity comparable to standard ascorbic acid (IC_{50} 69.13 ± 4.08mg/ml).This study suggests that leaves of *Calotropis procera* have bioactive compounds for a new antioxidant drug development greater capacity to scavenge DPPH radicals whereas leaf extract showed moderate free radical scavenging activity [34].

DISCUSSION

This study indicated the potential usefulness of *C. procera* (Ait) R. Br. leaves against different. A thorough review of the published literature on *Calotropis procera* shows that it is a popular remedy in a variety, as well as Ayurvedic and traditional practitioners for the treatment of a range of diseases. *Calotropis procera* is a plant with assorted chemical constituents which exerted many pharmacological effects. There is a great pledge for development of novel drugs from *Calotropis procera* to treat numerous human diseases. Researchers are exploring the therapeutic potential of this plant as it is likely to have more therapeutic properties than are currently known.

REFERENCES

1. Yelne, M., Sharma, P. & Dennis, T. (2000). Database on medicinal plants used in ayurveda, central council for research in ayurveda and siddha, New Delhi, 2: 69-73.
2. Anonymous. (1956). The wealth of India- A Dictionary of Indian raw materials and industrial products. Council of Scientific and Industrial Research, New Delhi.
3. Parrotta, J. (2001). Healing plants of Peninsular India. CAB International., Wallingford UK and New York, p. 944.
4 Kirtikar, K. & Basu. B. (1998). Indian Medicinal Plants. International Book Distributors, Dehradun, pp. 1606-1611.
5 Anonymous. (1996). Pharmacopoeia of India. Govt. of India, Ministry of Health, Controller of publication, New Delhi.
6 Rastogi, R. & Mehrotra, B. (1999). Compendium of Indian medicinal Plant. Central drug research Institute Lucknow, National Institute of Science, New Delhi, Vol. 2, 1st Edn.,p. 147.
7 Murti, Y., Yogi, B. & Pathak, D. (2010). Pharmacognostic Standardization of Leaves of *Calotropis procera* (Ait.) R.Br. (Asclepiadaceae). Inter. J. Ayur. Res., 1(1): 14-17.
8 Nandkarni, A. K. (2000) Indian Materia Medica, 1st Edn., pp. 242-245.
9 Seiber, J.N., Nelson, C.J. & Lee, S.M. (1982). Cardenolides in the latex and leaves of seven Asclepias species and *Calotropis procera*. Phytochem., 21: 2343 –2348.
10 Saber, A. H. & Maharan, G.H. (1969). Bulletin of the Faculty of Pharmacy, Crio university., 7: 91-104
11 Saxena, V.K. & Saxena, Y.P. (1979). Yoga and Homeopathy. J. of Research in Indian Medicine., 14:152-154.
12 Tiwari, K.P. & Minocha, P.K.(1978) Vijnana parishad. Anusandhan Patrika., 21: 177-178.
13 Carruthers, I.B. & Grifiths, D.J. (1984). Hydrocarbon from *Calotropis procera* in northern Australia. Biomass, 4: 275-282.
14 Khan, A.Q., Ahmed, Z. & Malik, A. (1988). A new pentacyclic triterpene from *Calotropis procera*. J. Nat. Prod., 51(5): 925-928.
15 Khan, A.Q. & Malik, A. (1989). A steroid from *Calotropis procera.* Phytochem., 28(10): 2859-2861.
16 Akhtar, N. & Malik, A. (1992). Proceragenin, an antibacterial cardenolide from *Calotropis procera*, Phytochem., 31(8): 2821-2824.
17 Olea, R.S., Oliveira, A.V. & Silveira, E.R. (2002) Organic carbonate from *Calotropis procera* leaves. Fitoterapia., 73: 263-265.
18 Ali, M. & Alam, P. (2009). Phytochemical investigation of *Calotropis procera* Ait roots. Indian Journal of Chemistry, 48 B: 443-446.
19 Abhishek, D., Mohit, C., Ashish, G., & Ameeta, A. (2010). Medicinal utility of *Calotropis procera* (Ait.) R. Br. as used by natives of village Sanwer of Indore District, Madhya Pradesh. *IJPLS,* 1(3): 188-190.
20 Esmail, A. & Al-Snafi. (2015). The constituents and pharmacological properties of calotropis procera-an overview. International journal of pharmacy review and research., 5(3): 259-275.
21 Kumar, V.L. & Basu, N. (1994). Anti-inflammatory activity of the latex *Calotropis procera*. J. Ethnopharmacol., 44: 123-125.

22 Setty, S. R., Prakash, T. & Prabhu, K. (2007). Hepatoprotective activity of *Calatropis procera* flowers against paracetamol-induced hepatic injury in rats. Fitoterapia., 78: 451-54.
23 Kumar, V.L., Dewan, S. & Sangraula, H. (2001). Anti-diarrhoeal activity of the latex of *Calotropis procera*. J. Ethnopharmacol., 76: 115-18.
24 Roy, S., Kumar, V.L. & Sehgal, R. (2005). Antioxidant and protective effect of latex of *Calotropis procera* against alloxan-induced diabetes in rats. J. Ethanopharmacol.,102: 470-73.
25 Sharma, J.D. & Sharma, P. (2000) *In-vitro* schizonticidal screening of *Calotropis procera*. Fitoterapia., 71: 77-79.
26 Soares, P.M., Lima, S.R., Matos, S.G., Andrade, M.M. & Vasconcelos, S.M. (2005). Antinociceptive activity of Calotropis procera latex in mice. J Ethnopharmacol., 99(1):125-9.
27 Kumar, V.L. & Basu, N. (1994) Anti-inflammatory activity of the latex *Calotropis procera*. J. Ethnopharmacol., 44: 123-125.
28 Iqbal, Z. & Jabbar, A. (2005). Anthelmintic activity of *Calotropis procera* (Ait.) Ait. F. flowers in sheep. J Ethanopharmacol., 102: 256-261.
29 Murti, Y. Sharma, S. & Mishra, P. (2015). In Vitro anthelmintic activity of *Calotropis procera* (Ait.) R.BR. leaves. Asian J Pharm Clin Res., 8(6): 188-190.
30 Kamath, J.V. & Rana, A.C. (2003). Pharmacological activities of ethanolic extract of *Calotropis procera* roots. Indian Drugs., 40 (5): 292-295.
31 Kareem, S.O., Akpan, I. & Ojo, O.P. (2008). Antimicrobial activities of *Calotropis procera* on selected pathogenic microorganisms. Afr J Biomed Res., 11: 105-110.
32 Prabha, M.R. & Vasntha, K. (2011). Antioxidant, Cytotoxicity and Polyphenolic Content of *Calotropis procera* (Ait.) R. Br. Flower. Journal of applied pharmaceutical science., 1 (7): 136-140.
33 Kamath, J.V., Rana, A.C. (2002). Prelimanry study on antifertility activity of *Calotropis procera* roots in female rats. Fitoterapia., 73: 111-115.
34 Murti Y, Yogi B, Pathak D. (2011). *In-vitro* antioxidant activity of column chromatographic elutes of different extracts of *Calotropis procera* (giant milkweed) leaves. J. Pharm. Res., 4(10):34-6.

CITATION OF THIS ARTICLE

B Yogi, S K Gupta and A Mishra. *Calotropis procera* (Madar): A Medicinal Plant of Various Therapeutic Uses-A Review. Bull. Env. Pharmacol. Life Sci., Vol 5 [7] June 2016: 74-81