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Review Article

Review on a potential herb *Calotropis gigantea* (L.) R. Br.

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Abstract: The beginning of civilization, human beings have worshiped plants and such plants are conserved as a genetic resource and used as food, fodder, fibre, fertilizer, fuel, febrifuge and in every other way. *Calotropis gigantea* is one such plant. In this review the systematic position, vernacular names, vegetative characters, Ecology and distribution, phytochemistry and the economical values of the *Calotropis gigantea* are discussed.
Keywords: *Calotropis gigantea,* sweta Arka, milk weed, crown flower, economic values.

INTRODUCTION

From pre-historic times to the modern era in many parts of the world and India, plants, animals and other natural objects have profound influence on culture and civilization of man. Since the beginning of civilization, human beings have worshiped plants and such plants are conserved as a genetic resource and used as food, fodder, fibre, fertilizer,fuel, febrifuge and in every other way [1],*Calotropis gigantea* is one such plant [2].

Plate 1: *Calotropis gigantea* (L.) R.Br.

In ancient ayurvedic medicine the plant *Calotropis gigantea* is known as "Sweta Arka" and *Caotropis procera* as "Raktha Arka". Both of them are often similar in their botanical aspects and also have similar pharmacological effects [3]. The systematic position, vernacular names, vegetative characters of the plant are given in the following Tables (1-3).

Table 1: Systematic position of the selected plant [3]

Kingdom	Plantae
Order	Gentianales
Family	*Asclepiadaceae*
Subfamily	*Asclepiadoideae*
Genus	*Calotropis*
Species	*gigantea*

Table 2: Vernacular Names[3-5]

India	(Sanskrit) Arka,Ganarupa, Mandara, Vasuka, Svetapushpa, Sadapushpa, Alarka, Pratapass, (Hindi) Aak, Madar, (Kannada) Ekka, (Tamil and Malayalam) Erukku, (Telugu) Jilledi Puvvu
Malaysia	Remiga, rembega, kemengu.
English	Crown flower, giant Indian milkweed.
Indonesia	Bidhuri (Sundanese, Madurese), sidaguri (Javanese), rubik (Aceh)
Philippines	Kapal-kapal (Tagalog).
Laos	Kok may, dok kap, dok hak.
Thailand	Po thuean, paan thuean (northern), rak (central).
Vietnam	B[oot]ng b[oot]ng, l[as] hen, nam t[it] b[at].
French	Faux arbre de soie, mercure vegetal.

Table 3: Vegetative characters

Habit	Shrub or a small tree up to 2.5 m (max.6m) height.
Root	Simple, branched, woody at base and covered with a fissured; corky bark; branches somewhat succulent and densely white tomentose; early glabrescent. All parts of the plant exude white latex when cut or broken.
Leaves	Opposite-decussate, simple, sub sessile, extipulate; blade-oblong obovate to broadly obovate, 5-30X2.5-15.5 cm, apex abruptly and shortly acuminate to apiculate, base cordate, margins entire, succulent, white tomentose when young, later glabrescent and glacouse.
Flowers	Bracteate, complete, bisexual, actinomorphic, pentamerous, hypogynous, pedicellate, pedicel 1-3 cm long.
Floral Characteristics	Inflorescence: A dense, multiflowered, umbellate, peducled cymes, arising from the nodes and appearing axillary or terminal
Calyx	Sepal 5, Polysepalous, 5 lobed, shortly united at the base, glabrescent, quincuncial aestivation.
Corolla	Petals five, gamopetalous, five lobed, twisted aestivation.
Androcium	Stamens five, gynandrous, anther dithecous, coherent.
Gynoecium	Bicarpellary, apocarpus, styles are united at their apex, peltate stigma with five lateral stigmatic surfaces. Anthers adnate to the stigma forming a gynostegium.
Fruit	A simple, fleshy, inflated, subglobose to obliquely ovoid follicle up to 10 cm or more in diameter.
Seeds:	Many, small, flat, obovate, 6x5 mm, compressed with silky white pappus, 3 cm or more long.

Ecology and Distribution

Natural habitat

Calotropis is drought resistant, salt tolerant to a relatively high degree, grows wild up to 900 meters (msl) throughout the country [6] and prefers disturbed sandy soils with mean annual rainfall: 300-400 mm. Through its wind and animal dispersed seeds, it quickly becomes established as a weed along degraded roadsides, lagoon edges and in overgrazed native pastures. It has a preference for and is often dominant in areas of abandoned cultivation especially disturbed sandy soils and low rainfall. It is assumed to be an indicator of over cultivation [3]

The chief features

- The plant grows very well in a variety of soils and different environmental conditions
- It does not require cultivation practices
- It is one of the few plants not consumed by grazing animals [7].
- It thrives on poor soils particularly where overgrazing has removed competition from native grasses [8].
- Some times this plant is the only survivor in some areas, where nothing else grows [6]
- It is drought tolerant and the pioneer vegetation in desert soil [8].
- Presence of latex, extensively branched root system and thick leaves with waxy coverage are the xerophytic adaptations[3].
- Hence, it is distributed in tropical and subtropical area of the world and throughout India. [6].

Geographic distribution

It is a native of India, China and Malaysia and distributed in the following countries: Afghanistan, Algeria, Burkina Faso, Cameroon, Chad, Cote d'Ivoire, Democratic Republic of Congo, Egypt, Eritrea, Ethiopia, Gambia, Ghana, guinea-Bissau, India, Iran. Iraq, Israel, Kenya, Kuwait, Lebanon, Libyan, Arab Jamahiriya, Mali, Mauritania, morocco, Mozambique, Myanmar, Nepal, Niger, Nigeria, Oman, Pakistan, Saudi Arabia, Senegal, sierra Leone, Somalia, Sudan, Syrian Arab Republic, Tanzania, Thailand, Uganda, United Arab emirates, Vietnam, Yemen, Republic of Zimbabwe, Exotic: Antigua and Barbuda, Argentina, Australia, Bahmas, Barbados, Bolivia, Brazil, chile, Colombia, Cuba, Dominica, Dominican Republic, Ecuador, French Guina, Grenada, Guadeloupe, Guatemala, Guyana, Haiti, Honduras, Jamaica, Martinique, Mexico, Montserrat, Netherlands Antilles, Nicaragua, Panama, Paraguay, Peru, Puerto Rico, St Kitts and Nevis, St Lucia, St Vincent, and the Grenadines, Surinam, Trinidad and Tobago, Uruguay, Venezuela and Virgin Islands (US) [3].

Propagation and management

The seeds freely float in the air and natural regeneration is very common. Vegetative propagation through stem and root cuttings is very useful in large scale multiplication of the superior genotypes.

Calotropis has been cultivated in South America and on the Caribbean Islands for the production of fibres at a spacing of 1-1.5m.When cultivated annualy yields of up to 500kg/ha are expected. A single harvest per season is preferable to a double or triple harvest; a single harvest would result in a net saving of energy input both on the form and in the

processing plant. It is well suited for intensive energy farming in arid or semi-arid regions where frost is not a limiting factor [3].

Phytochemistry of *Calotropis*

The previous workers have reported many phytochemical constituents in the various parts of *Calotropis gigantea* especially in the leaves. Usharin, gigantin, calcium oxalate, alpha and beta-calotropeol, beta-amyrin., fatty acids (both saturated and unsaturated), hydrocarbons, acetates and the benzoates, a mixture of tetracyclic triterpene compounds, terols, giganteol and giganteol are also found to be present [9, 10,11], Cardenolide calotropin [12],*α*-amyrin, *β*-amyrin, taraxasterol, *β*- sitosterol, *α*-amyrin methylbutazone, *β*-amyrin methylbutazone, *α*-amyrin acetate, *β*-amyrin acetate, taraxasteryl acetate, lupeol acetate B, gigantursenyl acetate A, gigantursenyl acetate B [13,14, flavonol glycoside, akundarol, uscharidin, calotropin, frugoside, calotroposides A to G [15] are responsible for many of its activities. The following cardenolides are also described in the literature: calactin, calotoxin, calotropagenin, proceroside, syriogenine, uscharidin, uscharin, uzarigenin and voruscharin [16,17,18]. Other compounds found are benzoylisolineolon and benzoyllineolone [19].

Flavonoids [15], triterpenoids [20], alkaloids, steroids, glycosides, saponins, terpenes, enzymes, alcohol, resin, fatty acids and esters of calotropeols [21] , volatile long chain fatty acids, glycosides and proteases [22] have been isolated from the various parts of the plant *Calotropis gigantea*.

The laticifer fluid of *Calotropis* [64], and found to have strong proteolytic activity, having the enzyme cysteine proteinase and aspartic proteinase. Due to the presence of these components, the plants are resistant to phytopathogens and insects mainly in leaves where the latex circulates abundantly. The milky latex of the plant is rich in lupeol, calotropin, calotoxin, and uscharidin, the latex protein. Sharma and Sharma *et al.,*screened the major phytochemicals viz. alkaloids, carbohydrates, glycosides, phenolic compounds/tannins, proteins and amino acids, flavonoids, saponins, sterols, acid compounds, resins in flower, bud, root of *Calotropis* (Table 4).

Table 4: Phytochemical components in *Calotropis* [23]

Sl. No.	Class of Compounds	Plant Part			Tests performed
		Flower	Bud	Root	
1.	Alkaloids	+	+	+	Dragendorff's test, Mayers test
2.	Carbohydrates	+	+	+	Molish test, Fehling test
3.	Glycosides	+	+	+	Keller killiani test
4.	Phenolic compounds/tannins	+	+	+	Ferric chloride test
5.	Proteins and amino acids	+	+	+	Xantho protein test
6.	Flavanoids	+	+	+	Ammonia test
7.	Saponins	+	+	+	With water With Na_2CO_3
8.	Sterols	+	+	+	Liebermann-Burchard test, Salkowski reaction, Hesse'sreaction
9.	Acid compounds	+	+	+	With Na_2CO_3, With litmus paper
10.	Resins	+	+	+	With double distilled water, With acetone and conc. HCl
11.	Peroxides	-	-	-	Potassium Iodide test
12.	Polyuronoids	-	-	-	Haemotoxylin test

Economic Values of *Calotropis*

Medicinal properties

Different parts of the plant have immense potential to cure various diseases and disorders (Table 5). It is used in various polyherbal preparations [24, 25]. There are more than hundred activities described in detail by Duke [26]. *Calotropis* is used alone and sometimes with other plants to cure variety of human and animals ailments.

Table 5: Medicinal properties

Sl.No	Medicinal properties	References
1.	Asthma	[27,28]
2.	Abortifacient	[29,30]
3.	Analgesic and Antinociceptive activity	[31]
4.	*Antifertility and emmenagogue*	[30]
5.	Anti-inflammatory activity	[32, 33]

6.	Anthelmintic activity	[34]
7.	Anti cancer activity	[35, 36]
8.	Anti dote for Scorpion stings and insect bites	[37]
9.	Anti tumor activity	[38]
10.	Anti-diarrheal and anti dyssentry activities	[38]
11.	Antimicrobial activity	[39]
12.	Antiviral activity	[40]
13.	Anxiety and pain	[41]
14.	CNS activity	[42]
15.	Cold	[59]
16.	Expectorant	[83]
17.	Cytostatic activity	[112]
18.	Cytotoxic activity	[12, 40, 50, 94, 112]
19.	Dyspepsia	[56, 72]
20.	Eczema	[59, 66, 83, 61, 62]
21.	Elephantiasis	[59, 66]
22.	Epilepsy	[80, 98]
23.	Elephantiasis of the legs and scrotum	[83]
24.	Expectorant	[82]
25.	Fever	[59]
26.	Fibrinolytic activities	[101]
27.	Free radical Scavenging activity	[89]
28.	Healing the ulcers and blotches	[56, 69, 72]
29.	(Goat) Motility of mature *Haemonchus contortus* of goat origin	[108]
30.	Indigestion	[83]
31.	kesarayer disease	[85]
32.	Leprosy	[28, 38, 53, 60, 62, 67, 68, 78, 87, 97, 107, 116]
33.	Liver injuries as well as on oxidative stress, Hepatoprotective	[38,67, 68, 87, 97]
34.	Mental disorders	[118]
35.	Migrine	[100]
36.	Nasal ulcer, laxative, rheumatoid arthritis, bronchial asthma, diabetes mellitus, nervous disorders	[92]
37.	Piles	[110]
38.	Pregnancy interceptive activity	[114]
39.	Purgative	[52]
40.	Removing anemia	[56, 69, 72]
41.	Rheumatism	[114]
42.	Ringworm of the scalp	[83]
43.	secondary syphilis, gonorrhea, ascites, helminthiasis, and jaundice	[61]
44.	Skin diseases	[67, 68, 97, 116]
45.	Spleen disorder	[110]
46.	Swelling and inflammation in sprain	[88]
47.	TB and leprosy	[73, 82]
48.	Uterus stimulant	[29, 63]
49.	Vermicidal activity	[71]
50.	(Vertenery) Camel diseases treatment	[46, 108]
51.	Worms	[38, 66, 67, 68, 97, 116]
52.	Wounds and ulcers	[38, 59, 67, 68, 97, 116]
53.	Wound healing activity	[27, 55, 61, 75, 90, 101]

Various other uses

Calotropis is a highly potential plant resource. The various uses of this plant are given in the Table (6).

Table 6: Other uses of *Calotropis gigantean*

S.No.	Activities	Parts Used	References
1.	Arrow poison	Latex	[48, 109]
2.	Biocidal activity	Latex	[79]
3.	Biogas and substitute for petroleum products	Whole plant	[111]
4.	Brewing and to curdle milk	The bark and latex	[99]
5.	Cleansing water	Leaves and its Saps	[99]
6.	Energy plantation	Whole Plant	[99]
7.	*(1)* ***Fibers***	Bark, and the silky hairs from its seeds	[91]
8.	Fodder	Young pods, Senescing leaves and flowers	[95]
9.	Fungicidal, insecticidal properties	Whole Plant	[49, 70, 74, 119]
10.	Isomers Accumulation	Whole Plant	[43]
12.	Latex or rubber	Latex	[89]
13.	Leather tanning	Whole Plant	[89]
14.	Manna like sugar and liquor (bar)	Sap	[99]
15.	Manure, Pest repellant	Twigs and Leaves	[99, 103, 117]
16.	Molluscicidal activity	Whole plant	[51, 77]
17.	Indicators of Heavy Metals	Leaf and Stem	[104]
18.	Mosquitocidal potential	Whole plant Petroleum ether– acetone extract,	[93, 115]
19.	Poly aromatic hydrocarbon contamination	Leaves	[6]
21.	Reclaiming salt lands	Whole plant	[99]
22.	To cool the air around homes	Plantation of Calotropis	[99]
23.	Substitute for paper	Leaves	[99]

CONCLUSION

The plant *Calotropis gigantea* is a plant with many curative principles and other economic values with the following features: a perennial shrub, distributed up to 900m elevation in the tropical and subtropical areas, growing in all types of soils and environmental conditions, requiring no cultivation practices. As a hydrocarbon rich plant this plant needs more investigation on the aspect of energy conversion.

The quality and quantity of the active principle which are important for many ailments are subjected to many factors such as climate, soil, etc.. In this way standardization of the phytochemicals by these factors are very important to establish the uses of the plant more effectively.

REFERENCES

1. Sureshkumar P, Chezhian A, Senthil Raja P and Sathiyapriya J; Computational selections of terpenes present in the plant Calotropis gigantea as mosquito larvicide's by blocking the sterol carrying protein, Bangladesh J Pharmacol, 2012, 7: 1-5.
2. Calotropis gigantea, R. Br., Bulletin of Miscellaneous Information, Royal Gardens, Kew, 1900;157/168: 8 – 12.
3. Gamble J S; Flora of the Presidency of Madras, Vol. I, II, III, Botanical survey of India, Calcutta, 1935.
4. Gamble JS; Asclepias gigantean, L. Sp. Pl., 1923, 2: 832.
5. Sastry CST and Kavathekar KY; In: Plants for reclamation of wasteland, Publication and Information Directorate, CSIR, New Delhi, 1990: 175 – 179.
6. Sharma AP and Tripathi BD; Assessment of atmospheric PAHs profile through Calotropis gigantea R.Br. leaves in the vicinity of an Indian coal-fired power plant, Environ Monit Assess., 2009, 149: 477 – 482.
7. Oudhia P, Kolhe SS and Tripathi RS, Legume Res., 1997, 20(2): 133 – 136.
8. Smith NM; Weeds of the wet/dry tropics of Australia - a field guide, Environment Centre NT, 2002: 112.
9. Murti PBR and Seshadri TR; Chemical composition of Calotropis gigantea: Part1. Wax and Resin components of the latex, Proc. Ind. Acad. Sci., 1943, 18: 145 – 159.
10. Murti PBR and Seshadri TR; Chemical composition of Calotropis gigantea Part II. Wax and Resin Components of the Stem Bark Proc. Ind. Acad. Sci., 1944: 8 – 18.
11. Murti PBR and Seshadri TR; Chemical composition of Calotropis gigantea : Part V. Further Examination of the Latex and Root Bark, Proc. Ind. Acad. Sci., 1945a , 21: 143 – 147.

12. Kupchan SM, Knox JR, Kelsey JE and Renauld JAS; Calotropin, a cytotoxic principle isolated from Asclepias curassavica L. Science, 1964, 146: 1685 – 1686.
13. Habib RM, Nikkon F and Rahaman M; Isolation of β-Sitosterol from methanolic extract of root bark of Calotropis gigantea (Linn), Pak. J. Biol. Sci, 2007: 1 – 3.
14. Sen S, Sahu NP and Mahato SB; Flavonol glycosides from Calotropis gigantea, Phytochemistry, 1992, 31: 2919 – 2921.
15. Crout DHG, Curtis RF and Hassall CH; Cardenolides. The constitution of calactinic acid, Journal of the American Chemical Society. Part V, 1963, 347: 1866 – 1975.
16. Brischweiler F, St6ckel K and Reichstein T; Calotropis-Glykoside, vermutliche Teilstruktur, Glykoside und Aglykone, 321. Helvetica Chimica Acta., 1969, 52: 2276 – 2303.
17. Singh B and Rastogi RP, Structure of asclepin and some observations on the NMR spectra of Calotropis glycosides, Phytochemistry, 1972, 11: 757 – 762.
18. Lardon A, Stockel K and Reichstein T; 2tx, 3/~, 19-Triacetoxy- 14/~-hydroxy-5a-card-20: 22-enolid: Teilsynthese zusatzlicher Beweis ffir die Struktur des Calotropagenins, Helvetica Chimica Acta., 1970, 53: 167 – 170.
19. Chandler RF, Coombe RG and Watson TR; The digltanols of the root bark of Calotropis procera R.Br, Australian Journal of Chemistry, 1968, 21: 1625 - 1631.
20. Pal G and Sinha NK; Isolation, crystallization and properties of calotropins D1 and D2 from Calotropis gigantean, Archives of Biochemistry and Biophysics. 1980, 202: 321 – 329.
21. Seiber JN, Nelson CJ and Lee SM; Cardenolides in the latex and leaves of seven Asclepias species and Calotropis procera, Phytochemistry, 1982, 21: 2343 – 2348.
22. Kitagawa I, Ru-Song Z, Jony DP, Nam IB, Yasuyuki T, Mayasuki Y and Hirotaka S; Chemical structures of calotroposides A and B two new oxypregnaneoligoglycosides from the root of Calotropis gigantea (Asclepiadaceae), Chemical and Pharmaceutical Bulletin, 1992, 40: 2007 – 2013.
23. Sharma P and Sharma JD; Evaluation of invitro schizontocidal activity of plant parts of calotropis procera. An ethanobotanical approach, J. of Ethanopharmacology, 1999, 68: 83 – 95.
24. The Wealth of India, Dictionary of Indian Raw Materials & Industrial Products, Publications and information directorate, Revised Edition, CSIR, New Delhi, 1992, 3: 78 – 84.
25. Tenpe CR, Upaganlawar AB, Dongre PA and Yeole PG; Screening of methanolic extract of Calotropis gigantea leaves for hepatoprotective activity, Indian drugs, 2007, 44(11): 874 -5.
26. Duke JA; Handbook of phytochemical constituents of GRAS herbs and other economic plants, CRC Press, Boca Raton, 1992.
27. Roy S, Uddin MZ, Hassan A and Rahman M M; Medico-Botanical report on the Chakma community of Bangladesh, J. Plant taxon., 2008, 15(1): 67 – 72.
28. Saxena HO; Observations on the ethnobotany of Madhya Pradesh, Bulletin of Botanical Survey of India, 1986, 28: 149 – 156.
29. Saha JC, Savani EC and Kasinathan S; Ecbolic properties of Indian medicinal plants. Part 1, Indian J. Med. Res., 1961**,** 49: 130 - 151.
30. Patel NK and Patel KB; Study of abortifacient plants used by Adivasi of Ambaji area in Danta taluka, Advances in Plant Sciences, 2004, 17(1): 37 – 40.
31. Nadkarni KM; Indian Materia Medica, Popular Prakashan Pvt. Ltd., 3rd revised and enlarged edition, vol. **1**, Mumbai, 1976: 237- 246.
32. Das S, Das MK and Basu SP; Evaluation of anti-inflammatory effect of Calotropis gigantea and Tridax procumbens on Wistar albino rats, J. Pharm. Sci. & Res., 2009, 1(4): 123 – 12.
33. Pardesi GS, Gadgoli C, Vaidya MD, Hasni HY, More BH and Bhuskat PP; Evaluation of anti-inflammatory activity of Calotropis gigantean, Pharmacology online, 2008, 1: 111 – 6.
34. Iqbal Z, Lateef M, Jabbar A, Muhammad G and Khan MN; Anthelmintic activity of Calotropis procera (Ait.) Ait. F. Flowers in sheep, Journal of Ethnopharmacology, 2005, 102: 256 – 261.
35. Sureshkumar P, Senthilraja P and Kalavathy S; in-silico docking analysis of calotropis gigantea (l.) r.br derived compound against anti-cervical cancer activity, World Research Journal of Computer-Aided Drug Design, 2012, 1(1):09-12.
36. Choedon T, Mathan G, Arya S, Kumar VL and Kumar V; Anticancer and cytotoxic properties of the latex of Calotropis procera in a transgenic mouse model of hepatocellular carcinoma, World J. Gastroenterol., 2006, 12: 2517 - 2522.
37. Hutt MJ and Houghton PJ; A survey from the literature of plants used to treat scorpion stings, Journal of Ethnopharmacology. 1998, 60: 97 – 110.
38. Jayaweera DMA, Medicinal Plants (Indigenous and Exotic) Used in Ceylon, Vol. **I-V**, National Science Council of Sri Lanka, Colombo, 1980–1982.
39. Ashraful MA, Rowshanul MH, Nikkon F, Rahman M and Karim MR; Antimicrobial activity of Akanda (Calotropis gigantea L.) on some pathogenic bacteria, Bangladesh Journal of Scientific and Industrial Research, 2008, 43: 397 – 404.
40. Locher CP, Burch MT, Mower HF, Berestecky J, Davis H, van Poel B, Lasure A, Vanden Berghe DA and Vlietinck AJ; Antimicrobial activity and anti-complement activity of extracts obtained from selected Hawaiian medicinal plants, Journal of ethnopharmacology, 1995, 49: 23 – 32.
41. Sharma V; Dravyaguna Vigyan, Chaukhambala Bharti Academy, Varanasi, 2001, 2:435.
42. Rama AAB and Pathak AK; CNS activity of Calotropis gigantea roots, J. Ethnopharmacol, 2006, 106(1): 142 - 145.

43. Abhilash PC and Singh N; Distribution of hexachlorocyclohexane isomers in soil samples from a small scale industrial area of Lucknow, North India, associated with lindane production, Chemosphere, 2008, 73: 1011 – 5.
44. Allen TF; Handbook of Materia Medica and Homeopathic Therapeutics, Jain Publishers Pvt. Ltd., New Delhi, 1994: 251.
45. Girach RDA. Observations on ethnobotany of the Bhunjia a, tribe of Sonabera plateau, Kalahandi, Orissa. Ethnobotany, 2001, 5: 84.
46. Antoine-Moussiaux N, Faye B and Vias GF; Tuareg ethnoveterinary treatments of camel diseases in Agadez area (Niger), Trop Anim Health Prod., 2007, 39: 83 – 89.
47. Argal A and Diwivedi A; Evaluation of Hepatoprotective Activity of Calotropis gigantea R.Br. Flowers Ethnobotanical leaflets, 2010, 14: 427 – 34.
48. Ashok P and Vaidya R; Pharm.Res.India, 2008: 44 - 45.
49. Ashraful MA, Habib MR, Nikkon F, Khalequzzaman M and Karim MR; Insecticidal Activity of Root Bark of Calotropis gigantea L. against Tribolium castaneum (Herbst), World Journal of Zoology,2009, 4 (2): 90 - 95.
50. Ayoub SMH and Kingston DG; Screening of plants used in Sudan folk medicine for anticancer activity, Fitoterapia, 1981, 52: 281 - 284.
51. Bakry FA; Use of some plant extract to control Biomphalaria alexandrina snails with emphasis on some biological effects: world Applied Sciences Journal, 2009, 6(10): 1335 - 1345.
52. Baldwin KT; Hawaii's poisonous plants, Petrogrypn Press Ltd., Hilo,Hawaii, 1979.
53. Bhalla NP, Sahu TR, Mishra GP and Dakwale RN; Traditional plant medicines of Sagar district, Madhya Pradesh, India, Journal of Economic Taxonomy and Botany,1982, 3: 23 – 32.
54. Murti P and Seshadr TR; Chemical composition of Calotropis gigantean: Part VI. Flowers. A Comparison of the Composition of the Various Parts of the Plant, Proc. Ind. Acad. Sci., 1945b:.304 – 309.
55. Biswas TK and Mukherjee B; Plant medicines of Indian origin forwound healing activity: a review, International Journal of Lower Extremity Wound, 2003, 2: 25 – 39.
56. Blair TS; A Practitioner's Handbook of Materia Medica and Therapeutics Based Upon Established Physiological Actions and The Indications In Small Doses, 1907.
57. Boericke W; Pocket Manual of Homeopathic Materia Medica and Repertory, Jain Publishers, New Delhi, 2001:157.
58. Brischweiler F, St6cklin W, St6ckel K and Reichstein T; Die Glykoside von Calotropis procera R.Br. Glykoside und Aglykone, 320, Helvetica Chimica Acta., 1969, 52: 2086 – 2106.
59. Caius JF; The Medicinal and Poisonous Plants of India, Scientific Publ., Jodhpur,1986.
60. Chaudhuri RHN, Pal DC and Tarafder CR; Less known uses of some plants from the tribal areas of Orissa, Bulletin of Botanical Survey of India, 1975, 17: 132 – 136.
61. Chitme HR, Chandra R and Kaushik S; Studies on anti-diarrhoeal activity of Calotropis gigantea R.Br. in experimental animals, J. Pharm Pharmaceut Sci, 2004, 7(1): 70 - 5.
62. Chitme HR, Chandra R and Kaushik S; Evaluation of antipyretic activity of Calotropis gigantea (Asclepiadaceae) in experimental animals, Phytotherapy Research, 2005, 19(5): 454 - 6.
63. Chopra RN, Nayar SL and Chopra IC; Glossary Indian Medicinal Plants. CSIR, New Delhi, 1956:46.
64. Cleverson DT, Jefferson EF, Soares oilveiva L, Maria Raguel A and Miranda nivea maria R; Enzymatic activity and protein profile of latex from calotropis procera, Plant Physiology and Biochemistry, 1996, 45(10-11): 781 – 789.
65. Crout DHG, Curtis RF, Hassall CH and Jones TL; The cardiac glycosides of Calotropis procera, Tetrahedron Letters, 1963, 2: 63 – 67.
66. Das BB; Rasraj Mahodadhi, Khemraj Shri Krishnadas Prakashan, Bombay,1996.
67. Dash B; Materia Medica of Ayurveda Based on Madanapala's Nighantu, B. Jain Publishers, New Delhi, 1991: 780.
68. Dassanayake MD; A Revised Handbook to the Flora of Ceylon, A.A. Balkema, Rotterdam, 1980–2000.
69. Ferrington EA; Clinical Materia Medica, Reprint edition, B. Jain Publ. Pvt. Ltd., Ganapathm. Kalyani Publishers Ludhiana, New Delhi, 1990: 347-353.
70. Ganapathy T and Narayanasamy P; Effect of Plant products on the incidence of major diseases of groundnut, International Arachis News letter, 1990, 7: 20 – 21.
71. Garg LC and Atal CK; Anthelmintic activity of Calotropain and Bromelain, Indian J. Pharm., 1963, 25: 422.
72. Ghosh NC; Comparative Materia Medica, Hannemann Publ. Co. Pvt. Ltd., Colicata, India, 1988.
73. Grange JM and Davey RW; Detection of antituberculous activity in plant extracts, Journal of Applied Bacteriology, 1990, 68: 587 – 591.
74. Haque MA, Nakakita H, Ikenaga H and Sota N; Development-inhibiting activity of some tropical plants against Sitophilus zeamais Motschulsky (Coleoptera: Curculionidae), Journal of Stored Products Res., 2000, 36(3): 281 - 287.
75. Havagiray R, Chitme, Chandra C, Kaushik S; Studies on anti-diarrheal activity of calotropis gigantean R.Br. in experimental animals, J Pharm Pharmaceut Sci., 2004, 7(1): 70 - 75.
76. http://www.hort.purdue.edu/newcrop/CropFactSheets/calotropis.html
77. Hussein HI and EL-Wakil HB; A pioneer molluscicidal and antifeeding agents from Calotropis procera extract against land snails, Journal of Pesticide Management and Environment, 1996, 1: 110 – 116.
78. Jain SK, Banerjee DK and Pal DC; Medicinal plants among certain Adivasis in India. Bulletin of Botanical Survey of India, 1973, 15: 85 – 91.

79. Jain SK., Sinha BK. and Saklani A; Medicinal plants known among tribal societies of India, Ethnobotany, 1989: 1 – 92.
80. Jain SK, Sinha BK and Saklani A; Medicinal plants known among tribal societies of India, Ethnobotany, 2001, 1: 92.
81. Kadhirvel K., Ramya S, Sudha TPS, Ravi AV, Rajasekaran C, Selvi RV and Jayakumararaj R; Ethnomedicinal Survey on Plants used by Tribals in Chitteri Hills Environ., We Int. J. Sci. Tech., 2010, 5: 35 – 46.
82. Kirtikar KR and Basu BD; Indian Medicinal Plants, Lolit Mohan Basu, Allahabad, India, 1935: 1606.
83. Kirtikar KR and Basu BD; Indian Medicinal Plants, Vol.2. International Book Distributors, Dehradun, 1975: 1606 – 1609.
84. Kshirsagar, Purnima A, Nargolkar, Kaushik, Bhandare A, Dodal A and Dodal T; Acute and subacute toxicity study of the ethanolic extract from Calotropis gigantea R.Br. in rodents, International Journal of Pharma and bio Sciences, 2010; 1(2): 1- 9.
85. Kumar SR and Vallikannan B; Carotenoid composition and retinol equivalent in plants of nutritional and medicinal importance: efficacy of beta -carotene from Chenopodium album in retinol deficient rats, Food Chemistry, 2009; 9: 47.
86. Lindley J; Flora medica, Ajay Book Services, New Delhi, 1985.
87. Lodhi G, Singh HK, Pant K and Hussain Z; Hepatoprotective effect of Calotropis gigantea extract against carbon tetrachloride induced liver injury in rats, Acta Pharma, 2009; 59: 89–96.
88. Manandhar MP; Folkloremedicine of Chitwan district Nepal, Ethnobotany, 1990; 2: 33.
89. Ahamed M, Rana, AC and Dixit VK; Plant Review Calotropis species (Ascelpediaceae): A comprehensive review, Pharmacognosy Magazine, 2005; (2): 48 – 52.
90. Nalwaya N, Pokharna G, Deb L and Jain NK; Wound healing activity of latex of Calotropis gigantea, International J. of Pharmacy and Pharmaceutical Sci., 2009; **1**(1): 176 – 182.
91. Nart T, Poonsab S and Gritsanaruck T; The environmental implications of the use of Calotropis gigantea as a textile fabric Agriculture, Ecosystems & Environment, 1984; **11**(3): 203 – 212.
92. Narumon L; Reviews: Medicinal plants in Tipitaka, Thai J. Pharmacol., 2005; 27(2-3): 121 - 126.
93. Neraliya S and Srivastava US; Effect of plant extracts on post-embryonic development of the mosquito Culex quinquefasciatus, J. Adv. Zool., 1996; 17: 54 – 8.
94. Oliveira S, Bezerra DP, Freitas CDT, Marinho-Filho JDB, Moraes OM, Pessoa C, Costa-Lotufo LV and Ramos MV; In vitro cytotoxicity against different human cancer cell lines of laticifer proteins of Calotropis procera (Ait.) R. Br., Toxicology In Vitro., 2007; 21: 1563 – 1573.
95. Orwa C, Mutua A, Kindt R, Jamnadass R and Simons A; Agroforestree Database: a tree reference and selection guide version 4.0 (http://www.worldagroforestry.org/af/treedb/).
96. Oudhia P; Calotropis gigantea: Useful Weed, 2001.
97. Pal DC and Jain SK; Tribal Medicine, Naya Prokash, Calcutta, India, 1998: 317.
98. Pathak AK and Argal A; Analgesic activity of Calotropis gigantea flower, Fitoterapia, 2007; 78: 40 – 2.
99. Pereira W and Seabrook J; Asking the Earth the Spread of Unsustainable Development, Second impression The Other India Press, Goa, India Mapusa, 1996; 403 - 507.
100. Prusti B and Behera KK; Ethno-Medico Botanical Study of Sundargarh District, Orissa, India Ethnobotanical Leaflets, 2007; 11: 148 – 163.
101. Rajesh R, Raghavendra GCD, Nataraju A, Dhananjaya BL, Kemparaju K and Vishwanath BS; Procoagulant activity of Calotropis gigantean latex associated with fibrin (ogen) olytic activity, Toxicon., 2005; 46: 84 – 92.
102. Rao K; Materials for the Database of Medicinal Plants, Karnataka State Council for Science and Technology, Bangalore, 2000.
103. Rathod VM; Control mashi in paddy, Honey bee, 1998; **9**(4): 13.
104. Samantaray S, Rout GR and Das P; Studies on the uptake of heavy metals by various plant species on chromite mine soils in sub-tropical regions of India, Environmental Monitoring and Assessment, 1999; 55: 389 – 399.
105. Samy RP and Ignacimuthu S; Antibacterial activity of some folklore medicinal plants used by tribals in Western Ghats of India, J Ethnopharmacol, 2000, 69: 63 – 71.
106. Satyavati GV, Raina MK and Sharma M; Medicinal plants of India. Indian Council of Medical Research, New Delhi, 1976; 1: 167 – 170.
107. Shah NC and Joshi MC; An ethnobotanical study of Kumaon region of India. Economic Botany, 1971; 25: 414 – 422.
108. Sharma LD, Bhaga HS and Srivastava PS; In vitro anthelmintic screening of indigenous medicinal plants against Haemonchus contortus (Rudolphi, 1803) Cobbold, 1898 of sheep and goats, Indian J. Anim. Res, 1971; 5: 33 – 8.
109. Sharma R; Medicinal plant of India (an Encyclopaedia), Daya publishing house, New Delhi ; 2003: 40 – 41.
110. Shiddamallayya N, Yasmeen A and Gopakumar K; Hundred common forest medicinal plants of Karnataka in primary healthcare, Indian journal of Traditional knowledge, 2010, 9(1): 90 – 95.
111. Shilpkar P, Shah M and Chaudhary DR; An alternate use of Calotropisgigantea: Biomethanation, Current science, 2007; 92: 425 – 436.
112. Smit HF, Woerdenbag HJ, Singh RH, Meulenbeld GJ, Labadie RP and Zwaving JH; Ayurvedic herbal drugs with possible cytostatic activity, Journal of Ethnopharmacology, 1995; 47: 75 – 84.
113. Soares PM, Lima SR, Matos SG, Andrade MM, Patrocinio MCA, de Freitas CDT, Ramos MV, Criddle DN, Cardi BA, Carvalho KM, Assreuy AMS and Vasconcelos SMM; Antinociceptive activity of

Calotropis procera latex in mice. Journal of Ethnopharmacology, 2005; 99: 125 – 129.
114. Srivastava SR, Keshria G, Bhargavana B, Singh C and Singha M.M; Pregnancy interceptive activity of the roots of Calotropis gigantea Linn. in rats, Contracep., 2007; 75: 318- 22.
115. Sureshkumar P; Phytochemical assessment on various extracts of calotropis gigantea (l.) R. Br. through gc-ms, Int J Pharm Bio Sci, 2013, 4(2 B): 803 – 810.
116. Taylor RSL, Edel F, Manandhar NP, Towers GHN; Antimicrobial activities of southern Nepalese medicinal plants, J.Ethnopharmacol., 1996; 50: 97- 102.
117. http://agritech.tnau.ac.in/success_stories/sucess%20stories_organic%20farming.html
118. Upadhyaya AS, Vartak VD and Kumbhojkar MS; Ethnomedicobotanical studies in western Maharashtra India, Ethnobotany, 1994: 6: 28.
119. .Usha K, Singh B, Praseetha P, Deepa N, Agarwal DK, Agarwal R and Nagaraja A; Antifungal activity of Datura stramonium, Calotropis gigantea and Azadirachta indica against Fusarium mangiferae and floral malformation in mango, Eur. J. Plant Pathol., 2009, 124: 637 – 657.
120. Valsaraj R, Pushpangadan P, Smitt UW, Adersen A and Nyman U; Antimicrobial screening of selected medicinal plants from India, J. Ethnopharmacol., 1997; 58: 75 – 83.