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ARKA (*Calotropisprocera*): A Review

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ABSTRACT:
*Calotropisprocera*is very important plant in Ayurved stream of medicine. It is used in different diseases in different combination. Different parts of the plant have been reported to possess various photochemical such as calotropin, calotropagenin, calotoxin, calotropagenin and voruscharine, steroids, stigmasterol, β-sitosterol, flavonoids, polyphenolic compounds, and various newer reported hydrocarbons and proteins. This shrub is famous to possess a wide range of pharmacological activities such as anticancer, antimicrobial, anthelmintic, acaricidal, antidiarrheal, insecticidal, anti-inflammatory, anticancerous, and larvicidal activities with other beneficial properties. It is well known for its pharmacological properties as it produces large amount of latex. Present Review of *Arka* (*Calotropisprocera*) highlights on Literature review regarding its vernacular names, synonyms, classification, geographical distribution, external morphology, Phytochemicals, Ayurvedic properties as well as pharmacological actions from different Ayurved *Samhitaa* and commentaries, *Nighantus*, and present modern science literatures, Books, Peer reviewed journals.

KEY WORDS: *Arka,*(Calotropisprocera), *Ayurvedsamhita,drrvya, guna, karma*(pharmacological actions)

INTRODUCTION

Calotropisprocera is a plant from Asclepiadaceae family, original from Africa, India and Persia and is known popularly as Jealousy, Jealousy cotton, silk, flower silk, milk. The scientific name of the family is derived from Asklepios, the Greek God of the medicine(1). This medicinal plant has stood out among the adopted to the semi-arid northeastern Brazil. It's a perennial shrub, can reach three fit tall. Its branches, leaves, stems and fruits are covered by serous, with strong presence of white latex, which flows in abundance when the tissue is broken (2,3).*Calotropisprocera*have been widely used in the Ayurvedic, Sudanese, Unani and Arabic forthe treatment of various diseases namely leprosy, ulcers, piles anddiseases of the spleen, liver and abdomen (4). The latex is used as anabortifacient(5), spasmogenic and carminative properties (6),antidysentric, antisyphilitic, antirheumatic, antifungal, mullusccide ,diaphoretic and for the treatment of leprosy, bronchial asthma and skin infection(7, 8).Different parts of the plant have been reported to possess anumber of biological activities such as proteolytic(9), antimicrobial (10),larvicidal(11), nematocidal(12), anticancer (13, 14), antiinflammatory (15). Its flowers possess digestive and tonic properties. On the contrary, the powdered root bark has been reported to give relief in diarrhea and dysentery(16). So it's one of the important Ayurvedic medicine used regularly. Present Review of *Arka* (*Calotropisprocera*) highlights on Literature review regarding its vernacular names, synonyms, classification, geographical distribution, external morphology, chemical constituents, Ayurvedic properties as well as pharmacological actions from different Ayurved*Samhitaa* and commentaries, *Nighantus*, and present modern science literatures, Books, Peer reviewed journals.

Description

Vernacular names

Arka has been mentioned by different names in different regions. Below are given regional names according to region.
Arabic- *Ushar*, *Ushaar*, Bengali- *Aakand*, English- *Madar*, Farasi- *Kharaka*, *Jahuk*, Gujarati- *Aakado*, Hindi- *Madar*, *Aak*, Kaanadi- *Ekka*, Konkani- *Ruvi*, Marathi- *Rui*, Malyaalam- *Erikka*, Punjabi- *Sakar-al Lighal*, Sanskrut- *Mandar*, Tamil- *Badaabadam, Erukku*, Telugu- *Mandaramu, Jilledu*.(17, 18)

Synonyms

Various synonyms have been used in texts for Arkaamong which some signify its external features, some signify its properties and some signify its action etc.
Arka- Names of the Sun,
Bhaskar- Names of the Sun,
Ravi- Names of the Sun,
Suyahvaa- Names of the Sun,
Kshiri- Presence of its milky juice,
Kshirparni- Presence of its milky juice,
Kshirkandak- Presence of its milky juice,
Shuklarka- Presence of white Flowers,
Shwetapushpa- Presence of white Flowers,
Vasuk- '*Teja'* lives in this,
Aasphot- It is always flowering,
Ganarupa- Due to many varieties of Arka,
Vikiran- It is always flowered plant,
Mandar- It is used as a drug in patients.
Alarka- It kills '*Vata-dosh'*&'*Kushtha'*(17, 18).

Classification

According to Aayurved, there is slight difference according to all *samhitas* as well as *nighantus*. Types are described according to these texts as follows.

- Bhav-prakash*Nighantu*- 1.*Shweta* 2.*Rakta*
- Raj *Nighantu*- 1.*Arka* 2.*Rajarka* 3.*Shuklarka* 4.*Shwetamandar*
- Dhanwantary*Nighantu*- 1.*Shwetapushpa* 2.*Raktapushpa*

- Madanpal*Nighantu*- 1.*Shweta* 2.*Rakta*
- Kaiyyadev*Nighantu*- 1. *Arka* 2.*Alarka*
- AshtangSangraha- 1. *Arka* 2.*Alarka*
- Ashtanghridaya- 1. *Arka* 2.*Alarka*
- CharakaSamhita- 1.*Arka*
- SushrutaSamhita- 1.*Arka* 2.*Rajarka*
- NighantuRatnakar- 1.*Rajarkab* 2.*Shwetamandarka*
- Rasajalnidhi- 1. .*Shwetarka* 2.*Raktarka*
- VanaushadhiChandrodaya- 1. *Rakta* 2. *Shweta*.

Scientific Classification(19):

Taxonomy
Kingdom : Planate
Subkingdom :Tracheobionata
Division :Magnoliophyta
Class :Magnoliosida
Subclass :Asteridae
Order : Gentian ales
Family : Asclepiadaceous
Genus : *Calotropis*
Species : *procera*

Geographical Distribution

*Calotropisprocera*is inborn to Southern Asia and Indo-China to Malaysia, West Africa, North and East Africa, Madagascar, and Arabian Peninsula. The plant is naturalized in Australia, Central America, North, South America, and West Indies. The species is now accepted and culture in many countries such as Mexico, Central and South America, Pacific islands, Australia, and the Caribbean (20, 21). Found throughout India, common in dry & hot places. It is also found at the base of Himalaya, Afghanistan, Egypt, Africa and Iran (22).

Habitat:

*Calotropisprocera*is mostly found in habitats with little competition from other plants. These plants tend to grow in dry and rugged habitats with little rainfall (150 to 1000mm) annually and areas with well-drained soil having 2000 mm of annual precipitation. The plant is commonly found on roadsides, beachfront dunes, and urban areas. It is also found in areas 1000 m above sea level. Due to its xerophytic nature it can grow and propagate under harsh desert conditions. It is also grown as an ornamental plant in dry or coastal regions in the world (23, 24).

External Morphology:

*C. procera*is a soft-wooded, evergreen perennial shrub with an average height of 2.5 m. A gash on any part of the plant allows white sap to profuse out. It has a corky, furrowed bark, gray in color. It has branched roots that are woody at the base. Leaves are opposite-decussate, sub sessile, and estipulate in morphology that is leathery in touch with fine hair. It has bell-shaped flowers that are shallow and bisexual, actinomorphic, pentamerous, hypogynous, pedicellate, multiflowered, umbellate, peduncled cymes, either axillary or terminal inflorescence. A total of five sepals, 4-5 mm long that are lobe shaped and conjoined at the bottom. Five petals that are also lobe shaped gamopetalous in nature and twisted aestivation. Androecium has five stamens, gynandrous, antherdithecous, coherent. Gynoecium is bicarpellary, apocarpus with styles united at their apex, peltate stigma that has five lateral stigmatic surfaces. Anthers are adnate to the stigma forming a gynostegium. The fruit of *C. procera*is inflated and fleshy, with subglobose to obliquely ovoid follicle. It produces a large amount of seeds (3 cm) that are small, flat, obovate, compressed with silky white pappusat one end (25, 26, 27)

Phytochemistry:

Phytochemically the plant has been investigated for cardenolides from the latex and leaves (28), triterpenoids(29, 30),

anthocyanins from flowers (31) and hydrocarbons (32). A systematic study on fresh and undried flowers has resulted in the isolation of pentacyclictriterpene that is calotropenylacetate,Procesterol. (33). The chemical and spectral studies identified as C-6, C-24 diepimer of stigmast-4en-6β-ol-3-one (34). *Calotropisprocera*contain proceragenin an antibacterial cardenolide(35).

*Calotropisprocera*leaves contained principally calotropagenin**,** calactin, calotoxin, calotropin, taraxasteryl acetate, *β*-sitosterol**,** *α*-amyrins, βamyrins.Leaves also contain organic carbonate and stigmasterol (36). The latex of *Calotropisprocera*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(37). The root of *C. procera*contains procerursenyl acetate and proceranol which were isolated by Ali et al., 2008**.** Root also contains n-Dotriacont-6-ene, glyceryl mono-oleolyl-2-phosphate, methyl myrisate, methyl behenate, glceryl-1, 2- dieapriate-3-phosphate (38).

Ayurvedic Properties and Pharmacological Actions (17, 18)**:**

***Prayojya Anga* (Useful Part):**

In various medicinal preparations root, leaves, Latex (*Arkakshir*), Flowers (In Unani) separately or collectively i.e.*pamchaamga* is used.

***Rasa Pamchaka*(Properties):**

Rasa - Katu, Tikta
Veerya -Ushna
Vipaaka- Katu
Guna -Laghu, Ruksha,Tikshna.
Prabhaava-No specific *prabhaava*

Karma*: Action on *Tridosha

Vaata - Vaataghna
Kapha–Kaphaghna.

Pharmacological Actions:

In *Aayurvedic*texts it is commonly known for its *Vishaghna* (detoxification) action, apart from this it's other actions are*Krumighna,Kushthagna,Gulmahara,Deepana, Kandughana, Vranaapaha, Arshoghna, Pleehaghna, Shvasaghna, Udarahar*. On the basis of these pharmacological actions it is used in many medicinal preparations.

Indications:

In classical *Aayurvedic* texts, *Arka* is indicated in following diseases mentioned according to *Srotasa*.

***Srotasa*- Indicated Diseases**

Pranavaha- KaasaShawaas.
Annavaha- Gulma, Arsha, Udar, Visuchika, Vamanopaga, Deepan, Krimighna, Pachana.
Udakavaha- Udar.
Rasavaha- Jwara, Kushtha, Swedajanan, Hrudayottejak.
Raktavaha- Kustha,Pleeharoga, Dadru, Raktashodhaka,Shotha, Raktapitta,Shlipad,Updamsha.
Mamsavaha- Vranapaha, Arsha.
Mutravaha- Mutrakruchra.

In addition to the above diseases, it is commonly indicated in all poisoning e.g. Snakebite, Scorpion bite, Rat bite etc.

***Matra*/ Dose:**

Svarasaa of leaves - 10-20ml
Churna of roots- ½-1 gm
Ksheer – ¼-3/4 gm
Pushpa- 1-3 gm

Desription of Arka According to *Samhitaas*

- **Charaka*Samhitaa*:**

a) In *CharakaSamhitaa*Arkais described in first chapter of *Sutrasthana* i.e. *Dirghanjivitiyaadhyaya* as a drug used in *Vamana* and *Virechana* (39).

b) In 3rd chapter of *Sutrasthana* i.e.*AaragvadhadhyayaArkatail* is included in *ManashiladiPradeha* which is very useful in *Kustha* (40).

c) Along with this, *Arka* is included in the following 3 *Mahakashayas* of the 4th

chapter of *Sutrasthana*. 1) *Bhedaniya* 2) *Vamanopaga* 3) *Swedopaga* (41).

- **Sushruta*Samhitaa*:**

In Sushruta*Samhitaa*, Arka is included in *Arkaadigana*(42). Also Arka is the main content of the following *Gana*(43).

Adhobhagahara
Shirovirechan
Vaata-sanshodhan

In *Sarpavishapratishedhaadhyaya* of *Kalpasthana*, Arka is described as *sarpavishaapaha*.(44)

- **AshtangaHridaya:**

In *AshtaamgaHridaya,Arka*is included in *Arkaadigana*&*Kaphashamakgana*.(45)

- **SharangadharaSamhitaa:** (46)

*In Shaaramgadhara*there are many reference, many of them are medicinal preparations which are processed by *Arka*e.g. *Arkaksheer*is the main ingredient of *Vajritail*. It is very useful in all types of *Kustha*.

Arkatail is the very important preparation described in this *samhitaa* which is mainly used in *pama*, *kacchu* and *vicharchika*.

- **Yogaratnaakara:** (47)

There are many references of *Arka* in Yogratnakara.e.g. *Arkaksheer* is used as *bhavanadravya* in *Vatavidhvamsarasa*, *Pravalpanchamruta*.

Pharmacological Action According to Modern Science:

- **Wound Healing Activity-**

Topical application of latex's sterile solution greatly complemented the wound healing process in guinea pigs. The latex significantly augmented the healing process by markedly increasing collagen, DNA and protein synthesis and epithelialization. Studies of wound healing have also been carried out for surgical wounds using ethanolicextract of bark (48, 49).

- **Analgesic activity-**

Analgesic activity of dry latex (DL) of *Calotropisprocera*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 LD50 was found to 3 g/ kg (50).

- **Anthelmintic activity-**

The anthelmintic activity of *Calotropisprocera*flowers in comparison with evamisole 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 *Calotropisprocera*flowers on live *Haemonchuscontortus*as evident from their mortality or temporary paralysis. For *in vivo* studies, *Calotropisprocera*flowers were administered as crude powder to sheep naturally infected with mixed species of gatrointrointestinal nematodes (51).The ethanolic extract of *Calotropisprocera*(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 Pheretimaposthuma as a experimental models. The results revealed that ethanolic extract, water fraction, n-hexane, and chloroform elute showed better activity as compared to n-butanol fraction and chloroform: methanol (9:1) elute of *Calotropisprocera*(Ait.) R. Br. Leaves (52).

- **Anti-inflammatory activity-**

The anti-inflammatory property of the *Calotropisprocera*was studied on carrageenin and formalininduced 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 (53).

- **Antidiabetic activity-**

In the present study, dry latex (DL) of *Calotropisprocera*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(54).

- **Anticancer activity-**

An attempt was made to evaluate free radical scavenging activity, cytotoxic activity and polyphenolic content of methanolic extract of *Calotropisprocera*flowers. Free radical scavenging activity was estimated using *in vitro* models like 1,1,-diphenyl-2-picrylhydrazyl (DPPH), hydroxyl radical, hydrogen peroxide radical, reducing power and ferric thiocyanate method. Cytotoxicity was analyzed 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 IC50 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 (55).

- **Antimicrobial activity-**

The antimicrobial effect of ethanol, aqueous and chloroform extracts of leaf and latex of *Calotropisprocera*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*(56)

- **Anti-diarrheal activity-**

The dry latex (DL) of *Calotropisprocera*(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 enter pooling (57).

- **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 *Calotropisprocera*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 (58).

- **Anticonvulsant-**

Maximal electroshock seizures (MES), pentylenetetrazol (PTZ), lithium-pilocarpine, and electrical kindling seizures models have been used to detect anticonvulsant effects of aqueous and chloroform extracts of *C. procera*roots (59). Chloroform extract proved to be more effective against seizures in MES and the PTZ models. Nevertheless both aqueous and chloroform extractions from roots were comparable in subsiding convulsions inlithium-pilocarpine and electrical kindling induced models (60).

- **Potency against Ulcer-**

Different ulcer models have been used to study the anti-ulcer activity of *C. procera*. The results proved to be significant as it inhibited aspirin, reserpine, absolute alcohol, and serotonin-induced gastric ulcerations in rats. Duodenal ulcers induced by histamine in guinea pigs were also greatly affected (61).

CONCLUSION

The thorough review of Arka (*Calotropisprocera*) shows that it is the popular drug used everywhere in the world, especially its use is described in detail in Ayurvedsamhita.From published literature its importance proves as medicine.. By using yuktipraman one can use this drug in different diseases in different combination.

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