Systematic Review on Phytoconstituents and Pharmacological activities of *Calotropis Procera*

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Abstract:

Major sources of the medicines are the plants, animals, minerals and metals. According to WHO, 80% world population is based on the herbal medicines for the basic healthcare requirements may be due to their safety and efficacy. *Calotropis procera* Ait. (C. Procera) is described in the Ayurveda as upvisha due to its toxic nature. However, plant have been reported for great therapeutic attributes in ancient and modern literature. Various activities like analgesic, antidiarrhoeal, wound healing, antiarthratic, antidiabetic, hepatoprotective and antimicrobial have been reported in recent studies based on C. Procera. Calotropon, calotropin, uscharine, etc. are some of the main chemical constituents found in the different parts of plant. Present review covers ayurvedic and modern literature based on *Calotropis procera*.

Keywords: *Calotropis procera*, Pharmacological activities, Calotropon, Calotropin,

INTRODUCTION

Ayurveda is the ancient science of life having a holistic healthcare approach. This science describes the benefits (hita) or non-beneficial (ahita) for the life. Ayurveda has three modes of treatments i.e. Hetu (cause), Ling (symptom) and Aushad (medicine). Major sources of the Aushadha are the plants, animals, minerals and metals. This system established the relationship between human and plants throughout the development of human culture. According to WHO, 80% world population is based on the herbal medicines for the basic healthcare requirements may be due to their safety and efficacy. Generally, herbal drugs are rich in the different chemical constituents which may be responsible for the multidimensional therapeutic attributes, and synergistic actions. *Calotropis procera* Ait. (C. Procera) is described in the Ayurveda as upvisha due to its toxic nature. However, plant have been reported for great therapeutic attributes in ancient and modern literature. Various activities like analgesic, antidiarrhoeal, wound healing, antiarthratic, antidiabetic, hepatoprotective and antimicrobial have been reported in recent studies based on C. Procera. Calotropon, calotropin, uscharine, calotoxin, calctin, uscharidin and calotropagenin are some of the main chemical constituents found in the different parts of plant. However, it has not been used in the main course of treatment due to its toxic nature. Present review covers ayurvedic and modern literature based on *Calotropis procera*.

*Calotropis procera* Ait.: (Arka)

In Ayurveda word ‘Arka’ is used in many contexts like for Sun, God indra, Tamra and saphatika etc. or also as plant. Arka is known in our country from the earliest time. This plant has number of ethnomedicinal use. In old time this herb is used for the treatment of cholera, indigestion and for worm infection. This plant is also used with combination of other herbs to treat the diseases like cold, eczema and diarrhoea. Arka is use in Ayurvedic formulation like arka lavana and arka taila and both they have great therapeutic activities. It is one of the upvisha dravya beyond that it is one of the important drug of Ayurveda and it is used from Vedic period.

Reference found in Vedic Kala:
Vedic kaal: The mythical origin of arka is available in kapishthalakatha samhita. In the same way it is found in Taittiriya samhita also. There are different names given to this plant in vedic period. In Shatpatbrahman it is explain by the name of Agni and anna. Agni, prana and aditya are also the name of this plant that are mentioned in vedic time. Shatpatbrahman relate arka with body parts like arkaparna with karna, arkapushpa with akshi etc.

Reference found in Various Samhita’s:

<table>
<thead>
<tr>
<th>S.N</th>
<th>Samhita</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Charaka samhita</td>
<td>Charaka mention it in ksheerivriksha and added it into Shatashodhana vriksha. Different uses of the plant also described like arka is best for dantapawana. Arka root is included in shirovirechan dravya.</td>
</tr>
<tr>
<td>2</td>
<td>Sushruta samhita</td>
<td>Sushruta mention arka for Kshara preparation method. Plant ankur use for the raktamokshana site when the blood is not discharge properly. In this samhita arka included in arkadi gana. Arka pushpa is described as kaphapittahara and also kustaghana. In sushruta samhita various uses of arka are also available.</td>
</tr>
<tr>
<td>3</td>
<td>Astang hrudy</td>
<td>Like charaka samhita arka is described as dantapawana. It is also repoted as kaphanasas. In this samhita the arka lepa with other medicine is described for infected wounds. Arka ksheera has been indicated for virechana in alarka.</td>
</tr>
<tr>
<td>4</td>
<td>Kasyap samhita 3rd century</td>
<td>In this samhita the combination of arka with other drugs indicated for pariseka and abhyanga in the patients of kaphaja sotha.</td>
</tr>
</tbody>
</table>

Table 3.7: Description of Arka in samhita

References found in Nighantu about Arka:

<table>
<thead>
<tr>
<th>S.N</th>
<th>Nighantu</th>
<th>Time period</th>
<th>Varga</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dhanvantari Nighantu</td>
<td>10-13th century</td>
<td>Karaveeradi varga</td>
</tr>
<tr>
<td>2</td>
<td>Shodhala Nighantu</td>
<td>12th century</td>
<td>Karaveeradi varga</td>
</tr>
<tr>
<td>3</td>
<td>Shadarasa Nighantu</td>
<td>20th century A.D</td>
<td>Tiktadravya skanda</td>
</tr>
<tr>
<td>4</td>
<td>Madanpala Nighantu</td>
<td>14th century</td>
<td>Abhyadi varga</td>
</tr>
<tr>
<td>5</td>
<td>Kaiyadev Nighantu</td>
<td>15th century</td>
<td>Oshadhi varga</td>
</tr>
<tr>
<td>6</td>
<td>Bhavaparakash Nighantu</td>
<td>16th century</td>
<td>Guduchyadi varga</td>
</tr>
<tr>
<td>7</td>
<td>Raj Nighantu</td>
<td>17th century</td>
<td>Karaveeradi varga</td>
</tr>
<tr>
<td>8</td>
<td>Priya Nighantu</td>
<td>21st century</td>
<td>Shatapushpadi varga</td>
</tr>
<tr>
<td>9</td>
<td>Adarsh Nighantu</td>
<td>20th century</td>
<td>Arkadi varga</td>
</tr>
<tr>
<td>10</td>
<td>Gunaratnamala</td>
<td>20th century A.D</td>
<td>Guduchyadi varga</td>
</tr>
</tbody>
</table>

Table: 3.8 Description of arka in nighantu

Taxonomic classification:

<table>
<thead>
<tr>
<th>Kingdom</th>
<th>Plantae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subkingdom</td>
<td>Tracheobionta</td>
</tr>
</tbody>
</table>
Super division: Spermatophyta
Division: Magnoliophyta
Class: Magnoliopsida
Subclass: Asteridae
Order: Gentianales
Family: Asclepiadaceae
Subfamily: Asclepiadoideae
Genus: Calotropis
Species: Calotropis procera

Vernacular names:
- Sanskrit: Ravi, Bhanu, Tapana
- Hindi: Aak, Madar, Akavana
- English: Madar Tree
- Gujarati: Aakado
- Marathi: Rui
- Oriya: Arakha
- Punjabi: Ak
- Tamil: Vellerukku, Erukku
- Kannada: Ekka, Ekkaddagida, Ekkegida

Ayurvedic properties of Arka:
- Rasa: Kattu, Tikta
- Guna: Laghu
- Veerya: Usna
- Vipaka: Katu
- Doshkarma: Kaphavatshamak, kaphapittashamak

Description of the plant:
Arka is a weed and produce milk so it is called as milk weed. This plant is found at the area of height 1000m. Arka, grow in dry area or where the rain fall is less. Plant is also known for ornamental value in mostly dry area. This plant is related to species of flowering plant and member of Apocynaceae family.

Figure: 3.1 Habitat of Arka

Macroscopy: 

The plant is shown in Figure 3.1.
Bark and branches: The bark of plant is thick and little rough and having yellowish brown colour. The twigs of the plant are of green colour and fleshy and also having fur like hairs.

Leaves: The leaves of the plant is simple but opposite to each other and thick. Leaves are grayish white in colour and young leaves of the plant are cottony. Leaves produce white latex when a cut is applied on the leaves.

Inflorescence: It arises from the bases of leaves in pedunculate cymes of 3-20.

Flower: Flower having five triangular white petals and five thick ovate petals. The colour of flower varies from base to tip that is white at the base and purple at the tips. The stigma of the flower is surrounded by stamens that are purple in colour from tip.

Fruit: Colour of fruit is green and ovoid in shape. Inside the fruit papery light brown colour seeds are present when it gets split into two parts.

Root: They are rough, fissured longitudinally, corky and soft, externally yellowish grey white from the internal side it is white in colour.

Microscopy:

Leaf: The transverse section of leave when seen under microscope it shows the lamina of leaf having single layer of epidermis. Epidermis is covered with thick striated cuticle. Some of the epidermal cells are also present on the upper and lower surface. In the leaves the parenchymatous cells are also present that are circular in shape. Intracellular space is present in ground tissues. Below the upper epidermis three layer of closely arranged palisade parenchyma cells are present.

Stem: In the stem the outermost layer is uniseriate having thick cuticle. The cells present are drum to rectangular and compactly arranged. There is presence of small amount of chloroplast in the cells. Endodermis layer of uniseriate cells form a wavy ring around the vascular bundles.

Root: A transverse section of root shows outermost cork tissues that are consist of 6-9 rows of tangentially elongated and radially arranged cells followed about 3-6 rows of moderately thick walled parenchymatous cells, vascular cambium present within the phloem consisting of 2-5 rows of thin walled, tangentially elongated cells xylem form the central part of root composed of vessels.

Distribution: This herb is present more or less in India mostly in dry places Afganistan, Arabia, Egypt, Iran, and throughout the African continent.

Chemical constituents of Arka:
The leaves and stalk of plant contain calotropin and calotropagenin whereas flower contain calotropenyl acetate and multiflavanol compounds. Calotropis procera is a milk weed and its latex contains cardenolide, proceraenin. Its root bark have benzoylinesolone. In the chemical identification this plant also shows occurance of triterpenoids, calotropursenyl acetate and calofriedelenyl, a norditerpynol esters, calotropternyl and ester oleanene triterpenes. Plant also have tannins, saponins, cardiac glycosides and bioflavonoids compounds.

Varieties of Arka:

Different varieties are mentioned in Nighantu:

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Nighantu</th>
<th>Varieties</th>
</tr>
</thead>
</table>

Figure: 3.2 Leaves, flowers and fruit of Arka.
Varieties according to Botany:  

a) *Calotropis procera* (Rakta)  
b) *Clotropis gigantean* (Sweta)

Therapeutic use:
Pama, vicharchika, swasa, pliha vrddhi, krmidanta, mukhaksata, arsa, sarpa visa, mukha krsnatwa, kasa.

Formulations:
There are many formulations prepared from arka like Arkaksiradi bindu ghrit, Arkaditaila, Arkadi gana kwath, Arkadi vati and arka lavana.

Treatment of Arka toxicity:
The latex of plant is toxic and the excessive intake of arkaksira causes vomiting and diarrhoea, polyurea and burning sensation in the tongue so for the management of this sugar is mixed in the cold water is given.

Dose: Twak churna 1.5-1g and flower 1-3g

Ayurvedic pharmacology:

<table>
<thead>
<tr>
<th>Pharmacological action</th>
<th>Part used</th>
<th>Extract</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anti inflammatory activity</td>
<td>Aerial</td>
<td>Aqueous and Methanolic</td>
<td>100-250mg/kg</td>
</tr>
<tr>
<td>Antifertility activity</td>
<td>Root</td>
<td>Ethanolic extract</td>
<td>250mg/kg</td>
</tr>
<tr>
<td>Hepatoprotective activity</td>
<td>Flower</td>
<td>Ethanolic extract</td>
<td>200mg/kg</td>
</tr>
<tr>
<td>Antidiarrhoeal activity</td>
<td>Aerial</td>
<td>Latex</td>
<td>500mg/kg</td>
</tr>
<tr>
<td>Antidiabetic activity</td>
<td>Aerial</td>
<td>Aqueous</td>
<td>400mg/kg</td>
</tr>
<tr>
<td>Anti hyperglycemic activity</td>
<td>Aerial</td>
<td>Aqueous</td>
<td>100-400 mg/kg</td>
</tr>
<tr>
<td>Anti tumour activity</td>
<td>Root</td>
<td>Ethyl acetate</td>
<td>10µg/ml</td>
</tr>
<tr>
<td>Antinociceptive activity</td>
<td>Latex</td>
<td>Aqueous</td>
<td>12.5, 25 and 50mg/kg</td>
</tr>
<tr>
<td>Antipyretic activity</td>
<td>Aerial</td>
<td>Etanolic extract</td>
<td>500mg/kg</td>
</tr>
</tbody>
</table>

Table 3.10: Pharmacological activities

Toxic profile of Arka:
C. Procera is a milk producing plant and known as milkweed. The latex produce by plant contains many compounds like alkaloids they are calotropin, catotoxin, calcilin and gigantean they are very harmful and having poisonous properties. The latex of C. Procera can cause permanently eye damage. It causes the diminish eye vision and reduces the endothelial cells in the eye with less pain. According to the Ayurveda, the eye damage is due to its kshara effect. Externally it also effects the part of the body like it causes the breaking of skin.
Internally if used in large amount accidently it causes vomiting diarrhoea. Hence, proper care should be taken when in contact with arka like proper washing of hands when working with plant and avoid it in contact of eyes because it can cause severe effect in eyes.

Conclusion:
C.Procera is potential herb with many curative principles and economic values. It is a traditional plant of Ayurvedic system having unique properties. The plant was used is being used since ancient time for the treatment of the various ailments. Recent investigations based on the C Procera have also been describing its role in treatment of chronic diseases including the cancer. Each part of C Procera has the therapeutic importance may be due to the presence of wide range of active chemical constituents.

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