Exploring the hidden potential of Arka (Calotropis procera Linn. & Calotropis gigantea Linn.), an Upavisha in the field of toxicology

Dr. Rukma CK, Dr. Shanti R Nair, Dr. Divya KM and Dr. Ittoop J Ancheril

Abstract

In Ayurveda, Upavisha are the group of drugs which are less toxic in nature and not so lethal but produces toxic symptoms on contact or on consumption. Arka is a well-known medicinal plant in Indian system of medicine and also it is one among the Upavishas. According to Charaka Acharya, Even an acute poison can become an excellent medicine if administered properly & On other hand even most useful medicine can act like a poison if handled incorrectly. Unique methodology of using semi-poisonous plants in treatment has shown good outcome in therapeutics. The drug Arka is an important ingredient of various classical vishahara yogas in clinical practice since ages. It is included under Bhedaniya (Vagbhata) Vamanopaga, Svedopaga (Charaka), Arkadi, Adhobhagahara Gana (Susruta) and also included under Guduchyadi Osadhi varga (Bhavaprakash). This review article includes overall information about plant Arka, its Botanical description, toxicological aspect, management, medico-legal aspect and therapeutic traditional uses and Arka containing Agada yogas mentioned in Keraleeya Visha Vaidya Granthas.

Keywords: Arka, Arka Ksheera, Upavisha, Prativisha, Calotropis, Agada yogas.

Introduction

Arka (Calotropis gigantea linn.) is one of the plants classified under semi-poisonous category termed as Upavisha. Upavisha are the group of drugs which are less toxic in nature and not so lethal but they produce certain toxic symptoms on contact or on consumption. They are having low potency [1]. Even an acute poison can become an excellent medicine if administered properly & On other hand even most useful medicine can act like a poison if handled incorrectly [2]. Arka is one among the Ekadasha Upavishas [3]. It is one of the Saaptap Upavishas [4]. Some mention it as one of the Nava Upavishas [5]. Some of the synonyms of Arka are manda, vasuaka, sada puspa, alarka & pratapasa. Arka is said to have 2 types i.e. Alarka/ Sweta Arka and Arka (based on floral colours) which are botanically white variety of Calotropis procera and purple variety of Calotropis gigantea respectively [6].

<table>
<thead>
<tr>
<th>Scientific Classification</th>
<th>Plantae</th>
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<tbody>
<tr>
<td>Kingdom</td>
<td>Angiosperms</td>
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<tr>
<td>(unranked)</td>
<td>Eudicots</td>
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<tr>
<td>(unranked)</td>
<td>Asterids</td>
</tr>
<tr>
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<td>Gentianales</td>
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<tr>
<td>Family:</td>
<td>Apocynaceae</td>
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<tr>
<td>Subfamily:</td>
<td>Asclepiadoideae</td>
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<tr>
<td>Tribe:</td>
<td>Asclepiadeae</td>
</tr>
<tr>
<td>Subtribe:</td>
<td>Asclepiadinae</td>
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<tr>
<td>Genus:</td>
<td>Calotropis</td>
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</tbody>
</table>
**Botanical name**: *Calotropis gigantea* linn.  
**Family**: Asclepiadaceae  
**Vernacular name**\(^{[4]}\):  
**Sanskrit name**: Arka  
**English name**: Madar  
**Hindi name**: Madara  
**Bengali name**: Aakondo  
**Malayalam name**: Errikke  
**Classification**:  
- **Ayurveda**: Sthavara visha varga, Upavisha  
- **Modern**: Irritant organic vegetative poison  
**Special Categorisation**\(^{[5]}\):  
- **Charaka**: Bhedaneeya, Vamanopaga, Swedopaga, Kseera traya  
- **Susruta**: Arkadi, Adhobhaghahara  
- **Vagbhata**: Arkadi  

**Distribution**: Calotropis grows all over India, especially in the warm areas, deserts and wasteland. It grows on rubbish heaps, by the roadside and in sand dunes.

**Plant description**: It is a tall shrub with yellowish white bark, oblong thick leaves and purplish/white flowers. Fruits are long, curved which break open on drying. It gets automatically perforated and soft cotton comes out. It has seeds which are spread everywhere by wind flow. Seeds are small black in colour. When stem, branches & leaves are cut, crushed or incised, it yields thick, acrid milky white latex called Arka ksheera (madar juice).The juice forms into a white clot or coagulum leaving a clear straw coloured serum after it is heated or allowed to stand for few hours. The coagulum yields a yellowish brown resin and a snow-white crystalline substance having formula C\(^{27}\)H\(^{46}\)O\(^{2}\) \(^{[7]}\).

**Flowering and Fruiting time**: Flowering occurs in spring and Fruiting during summer.

**Major Chemical Constituent**\(^{[8]}\): Calotoxin, Calotropin, Calactin, Uscharin. Arka ksheera contains all these constituents along with Trypsin.

**Toxic part used**: Root, stem, leaves, latex. **Fatal dose**: uncertain **Fatal period**: ½ - 8 hrs. Four Varieties according to Raja Nighantu. Arka, Sveta arka, Raja arka, Sveta mandaraka

**Ayurvedic Properties**\(^{[9]}\)  
Rasa – Katu, Tikta  
Guna- Laghu, Ruksha, Tiksna  
Virya- Usna  
Vipaka- Katu  
Karma-Vatahara, Rechana, Vishaghna, Dipana, Param Sodhana.

**Indications**: Visha roga, Visarpa, Udara, Gulma, Krimi, Kandu, Kustha, Vrana, Gulma, Medo roga, Udara, Arsas, Sopha, Pleeha.

**Arka- Therapeutic Uses**\(^{[10]}\)  
**Krimidanta sula**: Cotton piece is dipped in mixture of equal parts of Arka ksheera & Honey and placed over affected area.  
**Mukha ksata**: Mixture of Arka ksheera (1 part) and Honey (3 parts) to relieve local pain and inflammation in stomatitis.

**Arsas**: Mixture of Arka ksheera, haridra choorna (*Curcuma longa* linn.) & Sireesha bija choorna (*Albizia lebbeck* linn.) is applied over the affected part in chronic pile masses.

**Snake bites**: Arka leaves are given to chew in snake bite cases

**Lootha visha**\(^{[11]}\): Sireesha beeja is done Bhavana with Arka Ksheera 3 times,mixed with Pippali Choorna (*Piper longum* linn.) and given for Lepa,Pana,Nasya & Anjana 11.  
**Vrischika Visha**\(^{[12]}\): Lepa with Palasha beeja (*Butea monosperma* Linn.) mixed with Arka ksheera relieves pain due to scorpion bite.

**Alarka Visha**: Intake of combination of Arka ksheera, Palala, Taila & Guda.

**Table 1**: Arka containing AGADA YOGAS mentioned in some of the classics.

<table>
<thead>
<tr>
<th>Sl no.</th>
<th>Agada yogas</th>
<th>Indications</th>
<th>Parts used</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kshara Agada</td>
<td>Sarva vishahara, Dundhubhi pataaka alepana,takshaka darpa nashana.</td>
<td>Arka bhasma</td>
<td>S.S.</td>
</tr>
<tr>
<td>2</td>
<td>Mahasagandhi Agada</td>
<td>Sarva vishahara</td>
<td>Arka puspa</td>
<td>S.S.</td>
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<tr>
<td>3</td>
<td>Ekasara Gana</td>
<td>Sarva vishaghna</td>
<td>Arka puspa</td>
<td>S.S.</td>
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<tr>
<td>4</td>
<td>Sarvakarmika Agada</td>
<td>Vyantara visha</td>
<td>Arka puspa</td>
<td>A.S.</td>
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<tr>
<td>5</td>
<td>MritaSanjeevana Ghrta</td>
<td>Gara visha, Sarva vishaghna Sanjeevanam in visha-odvandha nrita</td>
<td>Arka mula</td>
<td>A.S.</td>
</tr>
<tr>
<td>6</td>
<td>Sanjeevana Agada</td>
<td>Gara visha,Jeevanam to visha-supta.</td>
<td>Arka puspa</td>
<td>A.S.</td>
</tr>
<tr>
<td>7</td>
<td>Amrta Ghrta</td>
<td>Sarva vishaghna, Sanjeevanam in visha-odvandha mrita</td>
<td>Arka mula</td>
<td>C.S.</td>
</tr>
<tr>
<td>8</td>
<td>Kapitthadi yoga</td>
<td>Grha godha visha</td>
<td>Arka beeja</td>
<td>C.S.</td>
</tr>
<tr>
<td>9</td>
<td>Kapotavitaadi yoga</td>
<td>Vrischika damsha</td>
<td>Arka ksheera</td>
<td>C.S.</td>
</tr>
</tbody>
</table>
Arka ksheera Shodhana [27]
To purify Arka ksheera, Tila (Sesamum indicum Linn.) is fried and put into it. Either 2 or 3 among the following combination of Ela, Maricha, Nagahwa & Pippali is fried and put into Arka Ksheera. Arka ksheera is coming under Dugdha varga and is abundantly used in mercurial operations [28]. They opine that Arka Ksheera is pure by itself and needs no purification [29]. Some suggest the same Sodhana vidhi (Purification method) as that of Suhi kseera(Euphorbia nerifolium Linn.) can be applied [30]

Arka ksheera properties [31]
Arka ksheera is having Tikta rasa and Laghu, Snigdha, Usnaguna. It is useful in Kushta, Gulma, Udara and is Srestha Virechana Aushadha. It also induces Vamana. It pacifies chronic Pile masses & mitigates Krimidanta sula. When applied on skin it has a Kshara action.

Formulations of Arka [32]
Arka lavana, Arka vati, Ravimuladi vati, Adraka ghrita, Mahavishagramba tailam, Vajraka tailam, Polavamkanna vimardhakha Tailam, Marichadi tailam, Shankha vati, Kshara gulla, Kalyanaka lavana, Tailokya Chintamoni Rasu.

Toxic Symptoms [33]
Orally: Madar juice is bitter in taste. Produces burning pain in throat & stomach. Followed by salivation, stomatitis, diarrhoea, vomiting. Pupils are dilated along with tetanic convulsions, collapse and death. Sometimes delirium may occur.

Locally: Skin Contact- Madar juice produces redness, inflammation & vesication. Can give rise to skin lesions resembling” Fabricated Injuries”. Eye Contact-Severe Conjunctivitis or dimness of vision or Blindness.

Internally: GIT Irritation and acts as Cerebro-spinal poison. Death occurs if madar root powder is used as snuff.

Treatment in Classics
1. Moosla vishapeeda treatment ie. Intake of combination of Rajani (Curcuma longa Linn.) Saindhava (rock salt), honey and ghee can be done [34].
2. Shhavara visha treatment ie. Sheetha Jala dhara, Intake of honey with ghee and Virechana can be induced as fast as possible. Or intake of cow’s milk with sugar in plenty. Or frequent intake of Karapurathu puspa (Gossypium herbacium Linn) Svarasa mixed with sugar [35].
3. Following measures can be taken for poisoning due to Arka ksheera [36]
   a. Intake of Tila (Sesamum indicum Linn.) kashaya with guda.
   b. Intake of Trvrt (Operculina turpethum Linn) with saindhava.
   c. Intake of Curry leaves (Murraya koenigii Linn.) with buttermilk/gingelly oil.
   d. Intake of Karapurathi (Gossypium herbacium linn) leaf made paste with rice wash along with Tila & guda.

Antidotes
For Arka ksheera, some of the antidotes are sugar solution, fresh leaf juice of Neeli, diluted leaf juice of tamarind and Castor oil.

Post-mortem signs [37]
Froth at nostrils, dilated pupils, stomatitis and inflammatory changes of GIT with ulceration. Stomach may show perforation. All visscra including brain shows congestion.

Medico-legal Aspect [38]
Calotropis procera root is a powerful poison for cobras & other poisonous snakes which cannot stand its’ smell. Madar juice is occasionally used for purposes of Suicide, Infanticide & homicide. Madar juice used by tanners for removing hair from skin, which also imparts a yellow colour to skin & destroys offensive odor of fresh leather. Madar juice often used for procuring Criminal abortion by administering orally or introducing into uterus through Abortion stick. Madar juice sometimes used as a Cattle poison, either given with fodder or introduced into rectum of animal. Both the varieties of Arka plant are used for poisoning darts & arrows in Africa. Accidental poisoning may sometimes occur from an overdose of medicinal preparation of Madar administered by quacks.

Discussion
Both Sveta & Rakta Arka are useful in medicinal preparations. But for Vishaghna yogas, white variety is more commonly used by traditional Visha Vaidyas of Kerala. Also studies have proved the analgesic, antivenom, anti-bacterial, anti-oxidant, anti-inflammatory activity, wound healing activity of white variety ie. Calotropis gigantean [39]. It is used in various disease conditions both internally as well as externally. Maximum formulations containing Arka is indicated in Kaphagata rogas, Twak vikaras and Visha damshas. Many ethno medicinal references are also available which suggests use of Arka as antidote in snake bite, scorpion bite & dog bite which is still practiced. Anti-fungal activity of latex suggests that Arka has a promising role in curing skin ailments. The anti-nociceptive activity & analgesic activities of dry latex have been proven [40]. Arka has anti-inflammatory, anti-pyretic, analgesic, wound healing & anti-bacterial action. All parts especially leaves are effective in Bronchial Asthma. Kerala Visha Vaidya Granthas have wide range of therapeutic applications with Arka. Due to Teekshna Usna Virya, Katu Tikta Rasa & Katu Vipaka such pharmacodynamics helping to combat action of Visha ie. Tadarthetaaari Chikitsa Also nothing is as effective as Visha (poison) to neutralize another poison, as it possesses Sukshma,


**Conclusion**

Plant based treatments and traditional medicine usage is gaining importance all over the world. Plants belonging to the *Upavisha* group can give quick relief from various diseases and other toxicological conditions when used both externally & internally. Many classical *Agada* preparations containing *Arka* are not practically in use in clinical practice and there remains a scope for research in this area.

**Acknowledgement**

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