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SIGNIFICANCE OF VEGETATIVE POISON ARKA (CALOTROPIS PROCERA) AND ITS STANDARDIZATION, METHODS OF DETECTION AND MEDICOLEGAL IMPORTANCE

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ABSTRACT

Standardization of herbal drugs is the need of the hour as the use and practice of traditional medicine has increased tremendously. Calotropis procera is a plant with multifaceted biological characteristics that make it a medicinally important species. It is well known for their pharmacological properties, since it produces large amount of latex. The leaves are said to be valuable as an antidote for snake bite, sinus fistula, rheumatism, mumps, injuries and body pain. The latex of Calotropis procera contains several toxic compounds having irritant and pro-inflammatory properties. Toxicological manifestations are described in both *Ayurveda* as well as modern science. It should only be used after thorough research on the plant because it has both therapeutic and harmful effects on humans. In the present study, an attempt has been made to standardize the *Arka* leaves and latex as per pharmacopoeial testing protocol and also to set out standard procedure for screening test for calotropis poison in a stepwise manner.

KEYWORDS: Ayurveda, Agadtantra, Arka, Calotropis. Dugdha, Detection.

INTRODUCTION

Agadtantra is an important branch among the *Ashtang Ayurveda* which describes *Ayurvedic* aspect of toxicology i.e. deals with *Nidana* and *Chikitsa* of poisoning caused by different *Sthavara* & *Jangama* poisons & as well as *Kritrima* poison.[1] *Arka* is included in a *Upavisha*

Varga by *Rasatarangini*[2] and *Rasaratnasamucchaya.*[3] It is a best drug of *Kapha-Vataja* disorder, it aggravates *Pitta*. It is specially indicated for *Shwasa, Kasa, Aruchi, Gulma, Kushtha, Udarroga, Kandu, Vrana* etc. having properties *Snigdha, Laghu, Tikta, Lavana Rasa (Arkadugdha), Katu, Tikta (Mulatwaka)* and *Ushna Virya*.[4]

It should only be used after thorough research on the plant because it has both therapeutic and harmful effects on humans. Locally, it can give rise to lesions resembling bruises on skin which at times can lead to pustule formation and vesication. Juice when installed into the eyes or coming in contact with eyes can result in severe conjunctivitis. When taken orally it produces bitter taste, burning pain in the throat, salivation, nausea, vomiting etc. followed by diarrhoea, pain in abdomen, mydriasis, tetanic convulsions, delirium, collapse and death.[5] Although the purifying method is not referenced in any classical text, it still needs to be utilised with caution. Every part of this plant is toxic, but latex and roots are more poisonous than leaves. The leaves of this plant have three toxic glycosides- calotropin, calotoxin and uscharin, whereas it's latex contains calotropin, calotoxin and calactin, which are caustic and considered poisonous in nature.[6] The latex is when heated or allowed to stand; it forms a white clot leaving a clear straw-coloured serum. The serum contains an active principle, gigantin, which is highly toxic, while the clot contains a less poisonous resin.[5]

Case Reports about toxicity of Calotropis

1) Ramya Iyadurai et al. reported a patient who experienced cardiovascular collapse after a traditional healer administered calotropis orally and topically to treat a snake bite. The toxidrome of this patient did not fit into the clinical presentation of any of the big four snakes associated with snake envenomation in our country.[7]
2) Shrikant Waikar, V.K. Shrivastava reported a series of 16 instances of calotropis-induced ocular toxicity that occurred over the course of three weeks. The common features in all cases were delayed diminution of vision over a period of 2-4 hrs, absence of pain after initial burning sensation, inferior conjunctival staining and corneal oedema with Descemet's membrane folds.[8]
3) Oral mucosa injury following ingestion of latex has been reported. The patient presented immediately following ingestion of the toxic dose of latex manifested with features of gastritis.[9]
4) In case series from Nalgonda in south India among 60 patients with Calotropis poisoning, most of the patients presented with abdominal pain (25%), hepatitis (16.6%), stomatitis

(20%), vomiting (13.3%), diarrhea (10%), hyperkalemia (5%), tachycardia (8.3%), convulsions (1.6%). There was no mortality in this case series.[10]

Screening tests for Calotropis procera[11]

1. Concentrated Hydrochloric Acid Test.

a. A small portion of residue of the extract is taken in a test tube
b. Few drops of conc. Hydrochloric acid are added to it and warmed slightly.
c. A greenish blue color is formed, which confirms the presence of Calotropis gigantea.

2. Concentrated Sulfuric Acid Test

a. A small portion of residue of the extract is taken in a test tube
b. Few drops of conc. Sulfuric acid are added to it.
c. A pink to purple color develops after few minutes, which confirms the presence of Calotropis gigantea.

3. Froehde's Test

a. A small portion of residue of the extract is taken in a test tube
b. 2 drops of Froehde's reagent are added to it.
c. A deep-green color develops, changing to blue, and finally to green color,which indicates the presence of Calotropis gigantea.

4. Ester Test

a. A small amount of the extracted portion is taken in the conical flask.
b. 5 ml of conc. Sulfuric acid is added to it.
c. Extract is then refluxed for 1 hour and cooled
d. Equal amount of water is added to the extract, and then refrigerated for 1 hour.
e. A characteristic fruity odor is noticed, which indicates the presence of Calotropis gigantea.

Microscopic Characters of Arka leaves: Transverse section of midrib showed upper and lower single layered epidermis, externally occurred with thick, few epidermal cells of both surface, 2 to 3 cells trichomes, epidermis followed by 3 to 8 collenchyma, parenchymatous cells thin walled, vascular bundle, xylem consist of mostly vessels and tracheids, lamina dorsiventral mesophyll differentiated into a palisade and spongy tissue, upper and lower

epidermis covered externally closely arranged palisade parenchyma cells, spongy parenchyma, vascular bundle also present in scattered in this region.

Evaluation of Physical constant: Physical constant have a major role in identification and purity determination of crude drugs. In the present study, physical constants such as total ash, acid insoluble ash, water soluble extractive, alcohol soluble extractive values were evaluated as per standard protocol.

Analytical parameters of Arka leaves.

Sr.no.	Test	Result
1.	Description	Leaf sub sessile, 6 to 15 cm by 4.5 to 8 cm, broadly ovate, ovate-oblong, elliptic
2.	Foreign matter	0.48 % w/w
3.	Total Ash	8.40 % w/w
4.	Acid Insoluble Ash	0.23 % w/w
5.	Water Soluble Extractive	26.25 % w/w
6.	Alcohol Soluble Extractive	6.94 % w/w

Analytical parameters of Arka Dugdha.

Sr.no.	Test	Result
1.	Description	White coloured milky liquid
2.	Moisture	92.14 %w/w
3.	Total Solid	7.86 %w/w
4.	Ph	5.61
5.	Weight per ml at 25^0C	1.0258 g/ml
6.	Total Ash	1.58 % w/w
7.	Acid Insoluble Ash	0.20 % w/w

Medico legal aspect[12], [13], [14],[15]

1) Roots of C. procera are poisonous to cobra snakes. Its root is used by snake charmers to frighten snakes away or to control them.
2) It can be used as cow poison by combining it with feed or by placing a cloth covered in the juice inside the rectum of animals.
3) The juice is applied on the skin to produce chemical lesion to bring a false charge of assault on an enemy.
4) Latex is sometimes used as a depository and arrow poison. For a criminal abortion, the juice is ingested or inserted into the uterus using an abortion stick, sometimes used for infanticide.
5) Madar juice is used by tanners for removing hair from skin which is also imparts a yellow color to skin and destroys offensive odour of fresh leather.

6) Accidental poisoning may sometimes occur from an overdose of medicinal preparation of Madar administered by quacks.

CONCLUSION

Calotropis is categorized under organic irritant poison. Above discussed screening/ spot test can be used for qualitative assessment of plant poisons, after extraction/isolation from biological materials, such as viscera, blood, urine etc. The microscopic evaluation of leaves of Calotropis procera, estimation of Ash values, water and alcohol soluble extractive, total solid, pH would be of considerable use in the identification of this drug. Empirical knowledge about medicinal plants plays a vital role in primary health care and has great potential for the discovery of new herbal drugs. These results could be a useful addition to current knowledge on the standardization and identification of Calotropis procera. The current study may be helpful in completing information regarding its identification and standardisation as well as in conducting additional research and revalidating its use in the Ayurvedic system of medicine.

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