

ARKA AND ITS BOTANICAL EQUIVALENTS: A CRITICAL ANALYSIS

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Abstract

Herbal medicines are an integral part of treatment in Ayurveda. For their proper clinical usage, correct botanical identification becomes first and foremost necessity. Ancient classical literature reports types of various plants based upon its floral colours, size and shape, etc. In this way, Arka has also been classified into various types by different authors of treatise and lexicons. Texts related to medicinal plants in general and Dravyaguna in particular have attributed different botanical sources to Arka and its variety. Thus, a controversy stills persists among the botanical and classical identities of Arka till date. This present work attempts to critically analyse the classical types of Arka from available literature and correlate them with the available botanical sources from different floras. Thus, it could be said that Rajarka is the white and purple variety of *Calotropis gigantea* L.R.Br. whereas the synonym Alarka, Shwetarka corresponds to white variety of *C.gigantea* exclusively. Arka can be taken as *Calotropis procera* Ait. and *Calotropis acia* Buch-Ham.as well. The pharmacological potential for *C. acia* which resembles *C. procera* is yet to be explored in detail.

Keywords: Arka; Botanical sources; Controversy; *Calotropis*.

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INTRODUCTION

In Indian literature, the word 'Arka' has been used in many contexts viz. for Surya (sun), Indra (God), Tamra (Cu), Sphatika (Quartz), etc. and as plant.^[1] Hindu culture considers Arka as a sacred plant and often its flowers and leaves are offered to Lord Ganesha, Shiva and Hanuman.^[2] Its medicinal properties has been described in different classical texts of Ayurveda and included under the category of upavishas (semi-poisonous plants).^[3] Though poisonous, this drug has been included not only in various therapeutic formulations of Ayurveda but also reported for its traditional usage in almost 16 states by approximately 50 tribes.^[4]

In ancient times, single plants have been categorised into different types based upon its size or colour of its various parts particularly the flower. In this way, Arka has been primly categorised into two^[5] or more types, according to the convenience of the authors, and each type has been attributed with different names along with pharmacological properties and actions. Still, a controversy remains persistent regarding its types. This controversy becomes more prominent when the recent experts of Ayurveda and medicinal plants started providing botanical names to these varieties of Arka. While reviewing the present literature, it is being observed that frequently quoted books in medicinal plants like Indian medicinal plants, Database on medicinal plants (Table 3), are also of different opinion about their botanical sources. Hence, it was thought worthy to review all the available literature to have a critical view in this regard. The present article is an attempt to critically analyse the classical types of Arka and correlate them with the available botanical sources.

In the present article, data related to types of Arka with their individual paryaya (synonyms), from available 3 Samhitas and 24 Nighantus were compiled. Each individual

paryaya was decoded by critically analyzing its meaning fusing Sanskrit literature and classified them according to different basis of nomenclature of synonyms.^[6] Literature regarding the botanical equivalents of Arka has been compiled and noted down from 11 floras and a detail, collective description of the similarities and variations of the morphological characters like leaf, flower & fruit of three botanical sources has been tabulated and represented in Table 4.

RESULTS AND DISCUSSION

Most of the Samhitas (1500 BC- 600AD), and Nighantus [8th century- 19th century] ^[7] have quoted two types of Arka; namely Arka and Alarka. The basis of the classification is the floral colours; the white flower variety of Arka has been named as Alarka, Rajarka, Mandaraka, etc. The synonyms used for Arka in the various Nighantus further add the controversies to the types of Arka. Some authors like Sir Ramnath Chopra, Bapalal Vaidya have further added to the confusion of botanical equivalents of Arka and Alarka. The botanical sources of Arka are often taken to be *Calotropis procera* Ait. by some while as *Calotropis gigantea* L. by others. But when the types of Arka are sought for botanical identities, it was found that both the species possess violet as well as white colour flower varieties.^[8]

Types of Arka

In case of Samhitas, Charaka has stated the use of root of two different types of Arka (Arka and Alarka) in Shirovirechana gana in vimanasthana,^[9] where as in Siddhithana too, Chakrapani has commented Alarka as Mandara. Acharya Sushruta has clearly classified on basis of floral colours in Sutrasthana, Dravya sangrahaniya adhyaya namely Arka to be red flower coloured variety and Alarka as Mandaraka.^[10]

On a critical analysis from over 17 nighantus, total 48 synonyms were found for the Alarka and 49 for Arka. If thought chronologically about the nighantus, the two types of Arka namely Arka and Alarka have been clearly delineated right from Ashtanga Nighantu (8th century) by quoting synonyms separately for the two. Further it is seen that Shodhala nighantu (12th century) has quoted synonyms for three types namely, Arka, Alarka and Shwetarka, which brings in confusion for their botanical sources. Later, Raja nighantu (14th century) has specified synonyms separately for four types of Arka i.e Arka, Shuklarka, Rajarka and Shweta mandaraka. Further, Bhavprakasha (16th century) has mentioned 2 types of Shwetarka. (Table 1)

Synonyms

Ayurveda entails the use of synonyms for the identification purpose of medicinal plants. The classification of synonyms used can be done based on the part used, its morphology, therapeutic usage, habit, etc. (Table 2)

Among the total of 97 synonyms of Arka, synonyms like Ganarupa, Mandara, Sadapushpi, Vasuka, Vikirana are common to both the varieties. This suggests the basic similarity in the external morphology of the two types of Arka. While, synonyms like, Shuklarka, Shwetakusum, Rajarka, etc. denote the difference in the floral colours as well as the dimensions of the white variety of the plant. Overall, the synonyms like Sadapushpa, Ganarupa highlight the flowering nature of the plant. Ravi, Bhaskar imbibe the hot potency of this plant if used therapeutically. The presence laticiferous ducts are understood from the Kshirini, Ksheeraparna, Ksheeradala, etc. indicating presence of milky exudates in the plant. Synonyms like Asphota, Vikirana draw attention to the dehiscent nature of the fruit of this plant whereas the synonym Tulaphala indicates presence of silky white coma on the seed. (Table 2)

Botanical equivalence of Arka from recent texts

Generally, two species of *Calotropis* (Asclepiadaceae) i.e. *Calotropis gigantea* L. and *Calotropis procera* Ait. are taken as the botanical sources of Arka in many texts of Dravyaguna and medicinal plants. (Table 3)

It is observed that Alarka which is given to be possessing white flower variety is attributed to *Calotropis procera* Ait. in these recent texts of medicinal plants whereas it is reported to possess purple flowers in almost all floras. In case of vernacular names in these texts, safed aak has been attributed to *Calotropis procera* by some authors.

Review from 11 floras shows that *Calotropis procera* and *Calotropis gigantea* are maximum mentioned botanical sources. Still, an additional third variety namely *Calotropis acia* Buch-Ham. has been mentioned by some floras. The comparable basic morphology of all the three is as follows (Table 4)

1) *Calotropis gigantea* L.

Leaf attachment has been quoted as subsessile, sessile. The shape of leaf has been given to be ovate/oblong/elliptical. Flora of British India has referred to cuneate shape. Base of leaf has been mentioned as cordate-amplexicaul in most floras. Apex has been stated to be acute / subacute. Texture of leaf has been quoted to be cottony pubescent, glabrous. In case of flower, the colour has been stated to white as well as purple in umbellate/corymbose cymes possessing ovoid buds. Gynostegium has been distinctly described in flora of Saurashtra to resemble a muslim topi (cap) which is ovoid in shape. Corona scales are truncate, hairy, auricled with curved base; lobes shorter than staminal column. Flowering has been given to be present throughout the year. Fruit has been reported to be green in colour by one flora only. Shape is boat-like, recurved.

Table 1: Types of Arka according various lexicons

Types	Names of the types	Lexicons that mention these types (11) to (34)
None	-	Dravyaguna samgraha, ^[11] Paryaratnamala, ^[12] Madhavdravyaguna, ^[13] Rajvallabha nighantu. ^[14]
Two	Arka, Alarka	Amarkosha, ^[15] Abhidhanamanjiri, ^[16] Abhidhanratnamala, ^[17] Ashtanga nighantu, ^[18] Nighantu shesha, ^[19] Madanadinighantu, ^[20] Shabdachandrika, ^[21] Shivakosha nighantu, ^[22] Saraswati nighantu, ^[23] Siddhamantra, ^[24] Saushruta nighantu, ^[25] Kaiyyadeva nighantu, ^[26] Hridayadipika, ^[27] Madanpala nighantu, ^[28] Priyanighantu, ^[29] Shaligrama nighantu. ^[30]
Two	Shwetarka, Raktarka	Bhavprakasha nighantu ^[31]
Two	Arka, Rajarka	Dhanwantari nighantu ^[32]
Three	Arka, Rajarka, Shwetarka.	Shodhala nighantu ^[33]
Four	Arka, Shuklarka, Rajarka and Shwetamandaraka	Raja nighantu ^[34]

Table 2: Correlation of synonyms of Arka with identification characters

Morphology		
Habit	Mandar	That which is like a tree and is white in colour
Flower	Raktarka,	Red coloured flower
	Shwetarka,	White coloured flower
	Shweta Pushpa	White coloured flower
Fruit	Asphota	Dehiscent fruit
	Vikirana	Dehiscence of fruit & scattering of seeds
	Shukaphala	Resembling parrot,
	Tula phala	Having cottony structure, (Seeds attached to silky white coma)
Leaves	Ksheerparna, Kshiradala	Milky exudates from leaves.
	Dirghapatra	Possessing long, broad leaves.
Latex	Kshirini,	Possessing milky exudates
Flowering season	Sadapushpa	Flowering throughout the year
	Ganarupa	Gregarious in nature
Pharmacological action		
Bodily function	Arka, Ravi, Bhaskar	Resembling sun Having Ushna and tikshna property
Skin tone	Rupika	Which brings back normal complexion
Bodily function	Pratapas	Hot in potency
Mythological importance		
Lord Shiva	Shivamallika, Pashupat, Shivashekhara	Offered to lord Shiva

Table 3: Botanical sources with their possible interpretations with the types of Arka

Botanical source	Interpretation as type of Arka	Authors references
<i>Calotropis procera</i> Ait	Alarka (Safed aak in hindi)	Kirtikar & Basu ^[35] R.N. Chopra ^[36] Bapalal Vaidya ^[37]
	Raktarka (Safedaak in hindi)	Database on medicinal plants, Vol 2 ^[38] Kirtikar & Basu
<i>Calotropis gigantea</i> L.R.Br	Arka	R.N. Chopra Bapalal Vaidya

Table 4: The distinct differences in the three *Calotropis* species

Leaf parts		Reference in flora *		
		<i>C. gigantean</i>	<i>C. procera</i>	<i>C. acia</i>
Attachments	Sessile	1,3,6,8,9,10,11	1,3,6,8,9	
	Sub-sessile	2,4,5,6,7,11	2,4,	
	Petiolate		9(shortly)	1,2,8
Shape	Ovate/obovate	1,2,3,4,6,7,	2,3,4,6,9	1,4,8
	Elliptic /oblong	2,8,9,10,11	1,4,7,8,9	1,8
	Cuneate	1,		
Base	Cordate	1,2,3,4,7,8,9,10,11	2,3,4,7,8,9	
	Amplexicaul	6,7,8,10	8	
	Auricled	4	4	
Apex	Acute/subacute	2,6,7,8,10,11	1,2 (more narrow), 6,7,8	4,8
	Obtuse	6,7	4	
	Acuminate	2,4,8	4,8	4,8
Dimensions	Sub-mucronate		7	
	4-8 X 1-4 inch	1,2,4,8,	1,2,4,8	1,4,8
	8-17 X 3-9 cms	6,7,9,10,11	6,9	
Texture	Cottony pubescent, glabrous	1,2,6,9,10	4,6,7,9	1
	Coracious	2,4	2(less cottony), 4	
	Tomentose	8,11	8	4,8

Flower		Reference in different flora *		
		<i>C. gigantean</i>	<i>C. procera</i>	<i>C. acia</i>
Colour	White/purple	1,2,3,4,6,7	7	
	Purplish white	8,10,11	8	4
	Lilac	4,6,	6	
	Purplish red		2(odoruous),4(scented)	
Inflorescence	Greenish at base, pink otherwise			8
	Umbellate cyme	1,2,4,6,9,10	1,6,9	4,8
	Corymbose cyme	2,4,8,9		
Corolla dimensions	½ to 2 inch	1,4,8	8	4,8 (calyx is half of corolla)
	2.5- 5 cm	2,6,7,9,10,11	6,7,9	
Nature of corolla	Deltoid, spreading lobes, buds ovoid	2,4,6,8,9		
	Revolvute, twisted	1,7,		
	Lobes erect, buds hemispherical		1,2,4,8,9	1,
Gynostegium	Lobes erect, buds conical, tapering			4(bluish/purplish patch near apex),8
	Like maharashtrian topi	-	6	
	Like muslim topi	6	-	
	Truncate, hairy, curved base, keel shaped, auricled	1,2,7,8	9	
Corona scales	Scales compressed	9,10	9,	
	Scales acute, No auricles, glabrous, equalling stamina column		1,2,8	
	Scales obtuse, upturned, muticous		7	
Flowering season	Lobes glabrous, pink, shorter than stamina column, auricled			8
	Throughout the year	2,4,5,6,8,9,11	4,5,6,8,9,10	
	Dec-july	7	-	
	January	10	2(cold season)	

	Fruit	Reference in flora *		
		<i>C. gigantean</i>	<i>C. procera</i>	<i>C. acia</i>
Colour & no.	Green	3	3	
	None	1,2,4,5,6,7,9,10,11	1,2,4,5,6,7,9,10,11	
	3-4 nos.	8	8	
Shape	Boat shaped	6,9,11	6,	
	Sausage shaped		7	
	Sub-globose			4,8
Size	Not mentioned	1,2,3,4,5,7,8,10	1,2,3,4,5,8,9,10,11	
	7-10 X3-5 cm	6,7,9,11	6,7,9	
	3-4 inch	1,2,	1,2,	4,8
Feature	1-1.5 inch	4	4,	
	Recurved	1,2,4,7,8	1,2,4,7,8,9	
	Glabrous	6	6	
Seeds	Ventricose, fleshy	3,11	3,	
	Smooth, cottony pubescent	8,9		
	with silky white coma	2,3,6,8,9	2,3,4,6,8,9	
	Ovate /broadly ovate	1,2,4,9	1,2,7,8,9	
	Flat	6,8	6,8	

* 1-Flora of British India;^[39] 2- Flora of U.P;^[40] 3- Flora of presidency madras;^[41] 4- Flora of Assam;^[42] 5- Forest flora of Gujarat;^[43] 6- Flora of Saurashtra;^[44] 7- Flora of Orissa;^[45] 8- Flora of upper gangetic plain;^[46] 9- flora of Maharashtra;^[47] 10- Flora of shimoga;^[48] 11- Flora of Udipi^[49]

Figure: Morphology of Arka (*Calotropis* species)



Figure 1: *Calotropis gigantea* L. (white)



Figure 2: *Calotropis gigantea* L. (purple)



Figure 3: *Calotropis procera* Ait



Figure 4: *Calotropis acia* Buch- Ham. *

*Source: National research lab, Jammu.

Retrieved from: <http://www.iiim.res.in/herbarium/asclepidaceae/images/>

Seeds have been reported to possess silky coma, ovate to flat in shape.

2) *Calotropis procera* Ait.

This plant has not been included in flora of Karnataka. Leaf attachment has been quoted by maximum as sessile but one of the floras has quoted to be shortly petiolate. The shape of leaf has been given to be ovate/oblong/elliptical. Base of leaf has been mentioned as cordate in most floras. Apex has been stated to be narrower than *C. gigantea*. Commonly acute / subacute has been given with a distinct report of sub-mucronate apex. Texture of leaf has been quoted to be less cottony, coracious. The leaves are lesser in dimensions than *C. gigantea*. In case of flower, the colour has been stated to as purple, purplish red with odour in umbellate cymes possessing hemispherical buds. Gynostegium has been distinctly described in flora of Saurashtra to resemble a maharshtrian topi which is hemispherical in shape. Corona scales are acute, glabrous, lobes equalling staminal column. Flowering has been given to be present throughout the year. Fruit has been reported to be green in colour by one flora only. Shape being sausage-like by one flora unlike in *C. gigantea*, recurved. Seeds have been reported to possess silky coma, ovate to flat in shape. Thus, *Calotropis procera* Ait. can be clearly distinguished from *C. gigantea* from coronal structure and shape of bud macroscopically.

3) *Calotropis acia* Buch- Ham.

Flora of U.P, Flora of Assam, Flora of upper gangetic plain, Flora of Orissa & flora of British India have described this variety of *Calotropis* genus. Panig listed this species from Barkuda, Chilka (scarce- a solitary plant among rocks on the edge of the lake. It is an herbaceous plant with petiolate leaves, otherwise closely resembling *C. procera*. leaves are petiolate, obovate / oblong in shape, base is not mentioned. Leaf apex has been

reported to be acute / subacute with tomentose texture. Floral colour has been mentioned to be purplish white and distinctly greenish at the base. Calyx is half that of corolla in size. Corolla has been reported to possess bluish/purplish patches near apex. Lobes conical. Corona lobes have been mentioned to be glabrous, pink, and shorter than staminal column with auricles. The flowering season and characteristics of its fruit are unavailable.

Classical types and the botanical source correlation:

The synonym like Buka which is an aromatic plant of *Oleaceae* family has been given to Alarka. The presence of aromatic odour in the white flower variety of *Calotropis gigantea* Linn. R.Br. has been reported in a scientific micrometric evaluation of white and purple varieties of *Calotropis gigantea*.^[50] Thus, Buka can be the white flower scented variety of *Calotropis gigantea* L.

The prefix Raja is often considered in lexicons for denoting the bigger in size variety of the concerned plant viz. Rajajambu (based upon bigger size of fruit), Rajpatha (based upon bigger size of leaves), Rajabadara (bigger fruit variety), etc. Hence, one can say the term Rajarka is probably *C. gigantea* possessing both the floral varieties as it is morphologically bigger than *C. procera* and *C. acia*. Besides, Rajarka has not been attributed with any specific floral colour in Shodhala Nighantu and Raja Nighantu.

The classification of almost all the lexicons give Arka and Alarka in which Arka can be attributed to the botanical sources *Calotropis procera* and *Calotropis acia* & purple flower variety of *Calotropis gigantea* and Alarka to be white flower variety of *Calotropis gigantea* L. The classification mentioned in Bhavaprakash is clearly based on floral colours. Hence, Raktarka can be taken as *Calotropis procera*, purple variety is *Calotropis gigantea* and *Calotropis acia*.

Shwetarka is white flower variety of *Calotropis gigantea* L.

Shodhala has mentioned three types wherein Arka may probably correspond to *Calotropis procera* and *Calotropis acia* as *Calotropis acia* is reported to have close resemblance with *C. procera*; Rajarka to be both the white and purple varieties of *C. gigantea* as the floral colour for Rajarka has not been mentioned and Shuklarka to be exclusively white variety of *Calotropis gigantea*. In case of Raja Nighantu's classification, Arka may be correlated with *C. procera*, Shuklarka with *C. acia* as the flowers are with purple patches but not entirely purple like *C. procera*. Rajarka can be attributed to botanical source of white and purple varieties of *C. gigantea* and Shwetamandaraka to be exclusively white variety as Mandaraka denotes the tree like appearance and shweta – white flowers which corresponds to white variety of *C. gigantea*.

CONCLUSION

Thus, it could be said that Rajarka is the white and purple variety of *Calotropis gigantea* L. whereas the synonym Alarka, Shwetarka corresponds to white variety of *C. gigantea* exclusively. Arka can be taken as *Calotropis procera* Ait. and *C. acia* as well. The Ayurvedic pharmacopoeia of India has made a mention of *C. procera* as Arka. The botanical variety of *Calotropis acia* Buch-ham. was found in addition to the two most well known varieties taken as Arka. The pharmacological potential is yet to be explored for *C. acia* which provides further knowledge regarding its resemblance with *C. procera*.

REFERENCES

- 1) Raja radhakantadeva Bahadur. Shabdakalpadruma, Vol. 1. 3rd ed. Varanasi: Chaukhambha Sanskrit series; 1967. p.98.
- 2) Anagha Ranade, Rabinarayan Acharya. An Appraisal On Ethno-Medicinal Claims of *Calotropis Procera* Ait. and *Calotropis gigantea* (Linn.) R.Br. - Two Source Drugs of Ayurvedic Medicinal Plant Arka. Global J Res.

- Med. Plants & Indigen. Med. 2014;3(12):475-488.
- 3) Sadananda Sharma. Rasatarangini. 11th ed. New Delhi: Motilal Banarasidas; 1979. Twenty four Taranga, 163-164.p 676.
- 4) Anagha Ranade, Rabinarayan Acharya. An Appraisal On Ethno-Medicinal Claims of *Calotropis Procera* Ait. and *Calotropis gigantea* (Linn.) R.Br. - Two Source Drugs of Ayurvedic Medicinal Plant Arka. Global J Res. Med. Plants & Indigen. Med. 2014;3(12):475-488.
- 5) Vahatacharya. Ashtanga nighantu (E-nighantu). Hyderabad: CCRAS & NIIMH. Arkadi gana, 15/121-123.
- 6) Acharya RN. Nomenclature of medicinal plants, through Classical term Paryaya (synonym) – A review (Shabdayan). 1st ed. New Delhi: Commission for scientific and technical terminology, Dept. of Higher education; 2011. p.121.
- 7) Banwarilal goud. Ayurved ka itihaas. 1st ed. Jaipur: Sakshi Publishing House; 2013. p. 25.
- 8) Anonymous. Reviews on Indian Medicinal Plants, Vol. 5. 1st ed. New Delhi: ICMR; 2007. p. 157, 162.
- 9) Charaka. Charaka samhita (Ayurveda Dipika Vyakhya). Yadavji Trikamji, editor. 1st ed. Varanasi: Chaukhambha Prakashan; 2011. Vimanasthana, 8/150. p.286.
- 10) Sushruta. Sushruta Samhita (Commentary of Dalhana). Yadavji Trikamji, editor. 1st ed. Varanasi: Chaukhamba Sanskrit Sansthan; 2010. Sootrasthana, Dravya sangrahanaya adhyaya, 38/19. p. 165.
- 11) Chakrapani. Dravyaguna Sangraha (E-nighantu). Hyderabad: CCRAS & NIIMH. Anupana varga, 14/11.
- 12) Madhavkara. Paryayaratnamala (E-nighantu). Hyderabad: CCRAS & NIIMH. 316, 1580.
- 13) Madhava. Madhava dravyaguna. (E-nighantu). Hyderabad: CCRAS & NIIMH. Vividhaushadhi Varga, 31-32.
- 14) Rajvallabh Vaidya. Rajvallabh nighantu. (E-nighantu). Hyderabad: CCRAS & NIIMH. Aushadhashray paricchheda, 6/89.
- 15) Amarsingh. Amarkosha. (E-nighantu). Hyderabad: CCRAS & NIIMH. Dvitiya kanda, Vanaushadhi varga, 81.
- 16) Bhisagarya. Abhidhan manjiri (E-nighantu). Hyderabad: CCRAS & NIIMH. Arkadi varga, Madanadi gana, 294.
- 17) Anonymous. Abhidhanaratnamala (E-nighantu). Hyderabad: CCRAS & NIIMH. Tikta skandha, 4/93-94.
- 18) Vahatacharya. Ashtanga nighantu (E-nighantu). Hyderabad: CCRAS & NIIMH. Arkadi gana, 15/121-123.

- 19) Hemachandra Suri. Nighantu shesha (E-nighantu). Hyderabad: CCRAS & NIIMH. Vriksha Kanda, 48.
- 20) Chandranandan. Madanadi nighantu (E-nighantu). Hyderabad: CCRAS & NIIMH. Dvavinsha gana, 1-2.
- 21) Chakrapani dutta. Shabdachandrika (E-nighantu). Hyderabad: CCRAS & NIIMH. Vrikshadi varga, 119-120.
- 22) Shivadutta. Shivakosha (E-nighantu). Hyderabad: CCRAS & NIIMH. 306.
- 23) Anonymous. Saraswati nighantu (E-nighantu). Hyderabad: CCRAS & NIIMH. Kshupa varga, 2/7-8.
- 24) Keshava. Siddhamantra (Commentary of Bopadeva) (E-nighantu). Hyderabad: CCRAS & NIIMH. Kapha vataghna varga, 5/90.
- 25) Amarsimha. Saushruta nighantu (E-nighantu). Hyderabad: CCRAS & NIIMH. Arkadi gana, 8/111-112.
- 26) Kaiyadeva. Kaiyadeva nighantu (E-nighantu). Hyderabad: CCRAS & NIIMH. Oshadhi varga, 1531-1539.
- 27) Bopadeva. Hriday dipaka nighantu (E-nighantu). Hyderabad: CCRAS & NIIMH. Ekpada varga, 90.
- 28) Nrupa Madanpal. Madanpal nighantu (E-nighantu). Hyderabad: CCRAS & NIIMH. Abhayadi varga, 322-323.
- 29) Sharma PV. Priya nighantu. 1st ed. Varanasi: Chaukhamba Surabharati Prakashan; 2004. Shatapushpadi varga, 65-67. p.87.
- 30) Shaligrama. Shaligram nighantu. 1st ed. Mumbai: Khemraj Srikrishnadas Prakashan; 2011. Guduchyadi varga. p. 223-224.
- 31) Bhavmishra. Bhavaprakash nighantu. Chunekar KC, editor, 1st ed. Varanasi: Chaukhamba Bharati Academy; 2010. Guduchyadi Varga, 67-72. p.289-292.
- 32) Mahendra Bhaugik. Dhanwantari nighantu. Sharma PV, editor. 1st ed. Varanasi: Chaukhamba Orientalia; 2008. Karviradi varga, 14-15.p.123.
- 33) Shodhala. Shodhala nighantu (Namsangraha & Gunasangraha). Chunekar KC, editor, Karviradi varga, 492, 399-400.
- 34) Narhari. Raja nighantu. Indradev tripathi, editor. 5th ed. Varanasi: Chaukhamba Krishnadas Academy; 2006. Karviradi varga. p. 302-303.
- 35) Kirtikar, Basu. Indian Medicinal Plants, Vol. III. 2nd ed. Dehradun: International Book Distributors; 1981. p.1606-1609.
- 36) Chopra RN, Nayar SL, Chopra IC. Glossary of Indian Medicinal Plants. 1st ed. New Delhi: NISCAIR; 1956. p.46-47.
- 37) Bapalal Vaidya. Some Controversial Drugs in Indian Medicine. 1st ed. Varanasi: Chaukhamba Orientalia; 2005. p.283-286.
- 38) Anonymous. Database on Medicinal Plants, Vol. 2. 1st ed. New Delhi: CCRAS, Dept. of ISM & H; 2001. p.69-74.
- 39) Hooker JD. Flora of British India, Vol. 4. 1st ed. Dehradun: International Book Distributors; 1984. p.17-18.
- 40) Upendranath Kanjilal. Forest Flora of Chakrata, Dehradun & Saharanpur forest divisions. 3rd ed. New Delhi: F.R.I Press; 1928. p. 344-346.
- 41) Gamble JS. Flora of Presidency of Madras, Vol 2. 1st ed. Dehradun: Bishen Singh Mahendra Pal Singh; 2011. p.831-832.
- 42) Kanjilal UN. Flora of Assam, Vol. 3. 1st ed. New Delhi: Om Sons publications; 1939. p. 281-283.
- 43) Patel RI. Forest Flora of Gujarat. 1st ed. Baroda: Forest Dept. of Baroda; 1971. p.203.
- 44) Bole PV, Pathak JM. Flora of Saurashtra, Part 3. 1st ed. BSI, Govt. of India; 1988. p. 64-66.
- 45) Saxena HO, Brahmam M. Flora of Orissa, Vol. 2. 1st ed. Bhubaneshwar: Orissa Forest Development Corporation; 1995. p.1082-1084.
- 46) Duthie JF. Flora of Upper Gangetic plain, Vol. 2. 1st ed. New Delhi: Bishen Singh Mahendra Pal Singh; 1994. p.47-49.
- 47) Singh NP, Lakshminarasimhan P, Karthikeyan. Flora of Maharashtra state, Dicotyledons, Vol. 2. 1st ed. Kolkatta: BSI, Govt. of India; 2001. p. 341-342.
- 48) Ramaswamy SN, Radha Krishnan, Govindappa Arekal. Flora of Shimoga district, Karnataka. 1st ed. Mysore: University of Mysore; 2001. p.368-369.
- 49) Gopalkrishna Bhat K. Flora of Udupi. 1st ed. Manipal: Indian naturalist, Inchara; 2003. p.370-371.
- 50) Anagha Ranade, Harisha CR, Rabinarayan Acharya, Switu Jani, Micro-Morphological and Micrometric Evaluation of White and Purple variety flowers of *Calotropis gigantea* Linn. R.Br. International Journal of Universal Pharmacy and Bio Sciences 3(5);2014.

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